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ARCHIVES OF OPHTHALMOLOGY.

ON THE DECLINATIONS OF THE VERTICAL MERIDIANS OF THE RETINA.

BY GEORGE T. STEVENS, M.D., PH.D., NEW YORK.

(With three figures in the text.)

First Paper.

IT is nearly a score of years since I contributed to the pages of ARCHIVES OF OPHTHALMOLOGY two articles on the subject of the directions of the retinal meridians,[1] a subject which at that time I regarded as one of much importance in respect to an understanding of the adjustments of the eyes and the treatment or correction of the anomalies of adjustments known as heterophoria and heterotropia.

The articles were followed by others in other periodicals, and the general substance of my observations up to the time was included in my work on *The Motor Apparatus of the Eyes.*[2]

Notwithstanding that the subject appeared to me of primary importance in its bearing upon the whole range of one of the departments of ophthalmology and that I felt quite confident that my colleagues would at once recognize the value

[1] "The Directions of the Apparent Vertical and Horizontal Meridians of the Retina," etc., ARCHIVES OF OPHTHALMOLOGY, No. 2, 1897; "Declinations of the Vertical Meridians of the Retina," *op. cit.*, No. 1, 1899.

[2] Stevens, *The Motor Apparatus of the Eyes*, 1906.

of a complete understanding of it, yet after so many years I am forced to confess that either through the imperfections in the method of presenting the facts or from some other reason, I was much too optimistic in my hope of seeing the subject made one of general interest.

So many circumstances have recently been brought to my attention which have emphasized the misfortune of regarding these leanings of negligible importance that I am induced to attempt once more to fix the attention of my colleagues upon what I regard as a subject of the very first rank.

In attempting to interest my readers I shall take the liberty of going over much general ground that I have already endeavored to cover in order that I may present my subject in as comprehensive a manner as the limits which I have assigned to the discussion will permit.

As, in the former discussion of the subject I recalled important facts which had been observed in respect to the leanings of the meridians of the retina, previous to the publication of the articles referred to, so I shall again refer briefly to the investigations of the learned and able explorers who had taken the leading steps in this branch of inquiry.

It is hardly necessary, in this connection, to recall to mind that from remote times the leaning of images has been observed in cases of obstruction, injury, or paralysis of the vertically acting eye muscles, and especially of paralysis of the obliques. The directions of such leanings of the image have long been carefully observed and described although never until recently have these leanings been measured in degrees. It is not to these pathological phenomena that we are now to direct our attention.

As a question of physiological importance Helmholtz, many years ago, called attention to the fact that he had found that the vertical meridians of his own eyes deviated from below upward, each 1¼°, or together 2½°. While he recognized this deviation of the vertical meridians he believed, and his experiments appeared to warrant him in the belief, that the horizontal meridians remain exactly horizontal.

Volkner, Donders, Meisner, and others, each by a method of his own, arrived at the conclusion that, in each of the individ-

uals reporting, exactly (or very nearly) the same deviation of the vertical meridians occurred while the horizontal meridians were precisely in the horizontal plane. Le Compt, in America, by still another device arrived at exactly the same conclusion in respect to his own eyes. It is a most interesting illustration of the contagiousness of ideas. There was possibly a foundation for this uniformity of results in a common defect of adjustment. Helmholtz had a tendency to a deviation of his eyes outward which he regarded as entirely typical; indeed he was quite subject to a conscious diplopia, yet he in all his experiments regarded his own eyes as typically adjusted and he assumed that his adjustments represented those of others who had, as he also assumed, proper adjustments.

That others of the observers whose results corresponded, as they believed, with those of Helmholtz had somewhat similar conditions of adjustments is strongly suggested by their writings as well as by the photographic portraits that have been published of some of them.

The result of these seemingly uniform observations by such a number of distinguished observers apparently established the doctrine of a normal and typical leaning of the vertical meridians of the eyes, outward from below upward of 2½°, *while the horizontal meridians corresponded to the actual horizon.*

Upon this basis Helmholtz constructed, by what must appear to us infinite labor and masterly skill in mathematics, his monumental doctrine of the horopter.

Except as I have, in a very general way, recalled above, no other conceptions of the leanings of the retinal meridians based upon scientific observations had, so far as I have discovered, been advanced previously to the articles published in this journal and to which I have referred.

It was while reading an article by an authority of repute in which he had occasion to speak of the theory of the horopter of Helmholtz which he did with scant respect, that I determined, if possible, to find a way, less technical and perhaps more easily comprehended, which would confirm the truth of the theory and demonstration of Helmholtz's work. To that end I devoted a great deal of study during many months.

While engaged in this study and with my mind fully charged with it, a trifling accident led me to devise the clinoscope to be used in the examination of the subjective phenomena as an instrument which would give far more exact results than any means that had been employed by the observers whom I have mentioned. Among the very first of the results obtained by the use of the new instrument was, to my great surprise, the discovery that, invariably, in absence of disease, the leaning of the horizontal meridians corresponded exactly, when there was leaning of the vertical ones with the latter, and that when there was no leaning of one there was none of the other. In other words, in absence of disease, the vertical and horizontal meridians were exactly at a right angle. It was very easy to see how the error in previous observations had been made. The unconscious endeavor to hold the horizontal meridians as nearly as possible true to the horizontal plane is much greater than the corresponding endeavor to hold the vertical meridians in place, as it was soon demonstrated by the clinoscope and as we shall see as we proceed.

But if the clinoscope proved the true relations of the vertical and horizontal meridians it also, at once, showed that while observers were probably correct in their suppositions that in their own eyes the vertical meridians did lean out above, it demonstrated other very notable facts of which these observers had taken no note.

Thus, for example, there was no such uniform rule as Herring,[1] Donders, Helmholtz, and others believed to be typical of eyes in general, but these leanings were, in different eyes, as varied as the refraction in an equal number of eyes.

Again the leanings of all the meridians were uniform,—for example, if the vertical meridian leans out from below above to the extent of 3°, the horizontal meridian leans up at the medial side to exactly an equal extent.

But the significance of the leanings is of infinitely greater moment than the mere physiological statement of the fact that there is a variety and a wide difference in their degree. Moreover it became perfectly evident that the conditions of

[1] *Beiträge zum Physiology*, p. 175.

heterophoria and heterotropia were in intimate relation to the conditions of declination. It was therefore a matter of eminent importance as a practical subject.

To the practical side we shall return in the course of the discussion. In fact it is in order to impress upon my readers the very practical side of the subject that I have been prompted to the writing of these articles.

Leaving this brief historical sketch we may first examine into the nature of these leanings and then consider the means of discovering them.

And, since it is more convenient to use a definite term than to continue the more general phrase employed by Helmholtz and others, for example, "A convergence of the vertical meridians downward," and similar descriptive phrases, especially since these phrases did not express the conditions correctly, I shall employ the term which I applied to these leanings in the articles to which I have already referred, namely, *Declination, or Normal Declinations of the Retinal Meridians.*

Now what, exactly, is the meaning of these terms? For there are tiltings of various degrees and in various directions of the retinal meridians under various circumstances which are not only normal but typical and absolutely necessary. It is therefore important to fix definitely in mind the precise meaning and limitation of the term *declination*, and I shall take the liberty to quote from my work on *The Motor Apparatus of the Eyes* the precise definition of the term employed in reference to the meridians of the eyes.

"*By Declination, or Normal Declination of the Retinal Meridians is meant the deviation of the vertical, horizontal, or any given meridian of the eye from the corresponding meridian of external space when the line of regard is directed in the median plane and in the plane of the horizon, the head being exactly erect, or, more technically, in the primary position.*"

Let us, in order to make this definition perfectly clear, refer to the diagram, Figure 1, which I also take from the work just quoted.

Let the circle *eac, dbf* represent the equator of the eyeball and let the line *ab* represent the normal position of the vertical meridian of the eye, the line of regard being as above stated.

If this vertical meridian (we might select any other meridian but the one here chosen is infinitely most convenient) corresponds precisely with the vertical direction of surrounding space there will be no declination of that meridian and *consequently of no other meridian*. But should the vertical meridian, while the line of regard is thus fixed in respect to the position of the head, vary from this precisely vertical position, as, for example, to the position indicated by the line *cd* or *ef*, it is evident that this meridian and with it all the other meridians would no longer correspond with meridians of the same name in space. In either case this deviation of the position of a meridian from the position corresponding to a meridian of the same name in space, results in what I have called a *declination*.

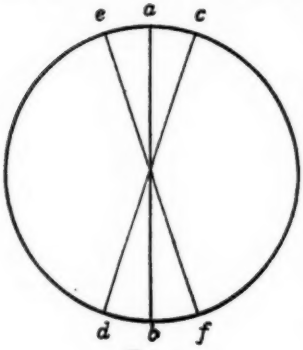

FIG. 1.

But it is exactly here that we are to guard against confusing such declinations with what are known as *torsions* of the eye.

Torsions are the normal and absolutely necessary changes in the directions of the meridians when the line of regard of the eye passes from the primary position to some oblique position, for example, downward and inward or upward and outward or even directly up or directly down. In all such changes of direction of the line of regard there must occur the rotations on the antero-posterior axis of the eye such as have long been known as torsions.

It seems, then, hardly necessary to say that the terms *declination* and *torsion* refer to absolutely different classes of conditions. One represents an anomalous position of the eye with reference to the cranium, the other refers to normal adjustments of the eyes to the differing relations of the line of regard to the cranium. One represents the anatomical relation of the eyeball to the cranium, the other the physiological and necessary changes in the directions of the meridians

corresponding to the changes in the direction of the line of regard.

I have emphasized the essential difference between the condition of declination and that of torsion because I have so frequently heard those who should know differently use these terms as synonymous. Such a misuse of terms suggests a very loose method of thinking on the part of the speaker or a sad lack of information regarding the conditions in question.

We may now consider the methods of determining, first the nature of declination, and second its presence and its extent.

The first and most important instrument devised effectually to examine into these conditions was the clinoscope. It was described in this journal in 1897.[1] Its primary purpose was to establish more correct data than had been previously obtained which might "harmonize the conflicting views of those inquirers who had left the subject of the horopter to be regarded, not as a subject of practical importance, which it surely is, but as an individual peculiarity varying with the experimenter and therefore of little if any physiological interest." It was not, at first, designed as a practical instrument for routine work but as a necessary means of obtaining correct data for determining a physiological condition. Almost at once it was found to be a most important, indeed, an essential working instrument in everyday professional investigations.

The instrument as described in 1897, valuable as it was, was found to need modifications in order to meet all the requirements both as an instrument for philosophical and for practical examinations. The tubes were too long to admit of the convergence sometimes required in philosophical tests, and the necessity for adjusting the haploscopic diagrams in the case of tilting the tubes upward or downward made it necessary to adapt it to the more technical uses of the investigator.

As a result of these modifications the tubes were made shorter and smaller and the objectives were attached to the tubes in such a manner as to permit of a modification of their relative positions to the tubes. The posterior ends of the tubes

[1] Archives of Ophthalmology, No. 2, 1897.

do not rotate, thus eliminating the possibility of a variation in the level of the two sight holes.

Thus modified the instrument consists of two tubes, the posterior half of each of which does not rotate while the anterior half rotates to the extent of 40° or more. The tubes are about 20 centimeters in length and are 2.50 centimeters in diameter. They are mounted on a brass platform which holds them in the same horizontal plane at a distance of 6.50 centimeters between the centers at the fixed point. A spirit level, extending transversely, indicates when the tubes are in the same horizontal plane. The attachment to the platform permits of an adjustment of the tubes in parallelism, in convergence or in divergence in the plane of the platform. This last is attached by a movable joint to the upright standard so that the instrument may be given any desired inclination to the horizon, within reasonable limits, and a scale and pointer indicate the dip with respect to the horizon.

Stevens's Clinoscope

The "primary position" of the head is assured by the aid of the adjustable buttons which are attached to the back of the instrument. One of these buttons should press against the forehead at the *glabella*, the other just below the nasal spine.

A small spirit level indicates when these two buttons are exactly in a vertical line with respect one to the other.

At the proximal end of each of the tubes is an opening of

about 12*mm* in diameter and behind each of these a small movable screen in which is an opening of about ½*mm* in diameter. By adjusting the distance between these two small openings they may be made to correspond to the interpupillary distance of the person to be examined. Still behind the screen is a clip which may be used for the insertion of a lens or prism from the trial case.

At the distal end of each tube is attached the objective which can be modified to suit the examination to be made but which, in routine practical work, consists of a pair of haploscopic diagrams as shown at Fig. 3. These diagrams are so attached to the tube that with any dip of the tubes they may remain in the vertical plane, an essential in examining the normal rotations or torsions of the eyes in convergence with depression of the plane of regard or with convergence and elevation of the same plane.

The posterior tubes do not rotate and thus do not cause variation in the level of the two sight holes, but the anterior half of the tube rotates by means of a lever, and a pointer and scale serve to indicate the exact position of the objective and its vertical line.

Soon after the introduction of the clinoscope I found that in exceptional cases, as for example in strabismus or other amblyopic cases, an instrument of a somewhat different character was needed, and I devised what was called a lens clinoscope which was described and figured in the *Ophthalmic Record* of May, 1898, and in the first number of this periodical for 1899. This instrument I have found of great use in the cases where it has been impossible for the patient to make out the small trial pointers in the clinoscope. It is essential in the examination of most cases of squint. About the same time I also devised an instrument in which a series of glass rods or a small plate of corrugated glass was placed before each eye behind the prisms of the phorometer, or the prisms placed horizontally without the phorometer. I was, at the time of its description, informed that a colleague was engaged with a model of a similar instrument. In this I was misinformed, for my colleague had only gone so far as to think that an instrument for the purpose we are discussing might be made from these corrugated glasses but had devised no instrument. This

latter instrument proved of very slight if of any value except in performing exercises in rotating the eyes on their antero-posterior axes.

So far as I am aware no other instruments have been devised which are of value in the examinations for declinations.

METHOD OF USING THE CLINOSCOPE.

To a certain extent the method of using the clinoscope must be modified by the character of the inquiry to be pursued.

Thus, for example, in a strictly scientific investigation of the law of torsions; before a technical examination of the varying of the meridians can, to advantage, be made, the normal plane of vision of the individual to be examined must be established and the condition of anophoria or of the opposite condition, if either is present, must be taken into consideration. In the first case the tubes of the instrument must be elevated to an extent that will compensate for the angle of anophoria. On the other hand, with normally depressed plane of regard the tubes are to be depressed. For example, should the upward rotation of the eyes reach 40°, the tubes should be elevated 5°, while the head is maintained in exactly the primary position. In examining in other planes allowance for this 5° must be made.

For technically accurate investigations, as, for example, in investigating the principles of the Law of Listing, these conditions are to be observed with great precision.[1]

In routine everyday examinations the demands for absolute precision in these respects may not be as imperious. Thus, in a routine examination, unless the deviation of the plane of regard from the actual plane of the horizon is quite pronounced or unless the conditions of heterophoria are likely to essentially modify the test for declination, little attention may be demanded in this direction.

We may then proceed to discuss the routine method for examination when the plane of regard is in the plane of the horizon.

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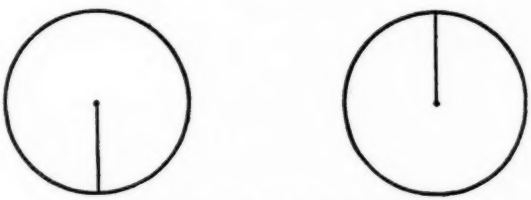
[1] For a discussion of the position of the plane of regard see ARCHIVES OF OPHTHALMOLOGY, No. 3, 1896; also *The Motor Apparatus of the Eyes.*

The clinoscope should be placed upon a table the height of which can be adjusted in such a way that the person to be examined shall not be obliged to elevate or depress the plane of regard when looking into the tubes, the position of the head being determined by the guide buttons. In other words, the subject of the examination should direct the gaze exactly in the primary plane.

The very small openings in the little screens at the proximal ends of the tubes should be set at the exact pupillary distance of the eyes and the tubes should be parallel and level, this last condition being indicated by the spirit level on the instrument. The longitudinal axis of the tubes should also be in the horizontal plane.

The examined person then directs the eyes to the distal ends of the tubes where will be seen the test objects. In the practical work of the consulting room the best test objects are the dots and pointers as they are shown at Fig. 3.

FIG. 3



Objective Lines for the Clinoscope

At first the two disks will appear separate, but after a moment they should unite. Should this not occur readily a prism of a small angle may be slipped between one of the eyes and the eyepiece when the images will generally unite. The prism may then be removed. If the dots should not appear completely united the fact may be ignored.

In high degrees of heterophoria prisms may be inserted in the clips to correct in some measure the deviations. Or if there is high degree of myopia or in the case of advanced presbyopia spherical lenses may be placed in the clips. The weakest lens that will enable the examined person to obtain a clear view of the test objects is always to be chosen.

These preliminary conditions arranged, the examined person is asked in regard to the directions of the pointers. For example, does that pointing from the middle of the disk upward point exactly vertically or does it lean to the right or to the left. Gradually the pointer is brought to what the examined person regards as vertical. Then the direction of the other pointer is determined. But the examiner is not to be satisfied by the first impression of the examined. The pointers should be varied in direction, to right and to left, until it is not a question of first impression but of settled observation that the pointers in a certain position represent to the examined the exact vertical position of each line. Of course no suggestion by the examiner should be permitted.

Even with this care a second examination on the succeeding day may modify the result of the first examination, but after two or three careful tests of this kind the examined person rarely varies in his determination of the position of the lines.

If there is amblyopia as there often is in strabismus cases the lens clinoscope is most useful or even indispensable.

The direction of the test lines as indicated by the pointers above the tubes is recorded, at 0° if the pointer is at that position, or should it vary toward the median direction the degree is recorded as *minus*, while should it vary toward the temporal direction it is recorded as *plus*. Thus, for example, we might have a record of Right, 0°; Left, + 3°; or Right, − 1°; Left, + 4°; etc.

As I shall attempt to show as we proceed that heterophoric conditions, esophoria, exophoria, hyperphoria, are in reality the manifestations of declinations and that the rational and effectual correction of heterophoric conditions depends upon the correction of declination, it follows that the routine determination of declination is of great importance and that ***in case of a proposed operation for strabismus or for heterophoria the information to be obtained by the clinoscope is not only important but essential.***

The process of examination has been described in much detail, yet it is in fact very simple and when the examiner has once acquired the method the routine work of making such examinations is neither lengthy nor tiresome.

Having thus sketched the procedure in testing in routine practice, a few brief suggestions regarding the more technical examinations in the physiological field may not be out of place.

The clinoscope may be directed in an ascending or descending plane and the scale of degrees attached to the tubes and extending downward at the standard marks the degree of inclination to the horizon. We may therefore compare the directions of the meridians when the gaze is directed above or below the horizon. The guides at the proximal end of the instrument should be adjusted to maintain the exact primary position of the head, or, if it is preferred, the guides can be adjusted so that the gaze will of necessity be directed up or down from the primary plane while the tubes remain horizontal. The first method will, in general, be found most convenient.

With such elevation or depression of the plane of regard the tubes may maintain parallel relations or they may be caused to converge for a certain distance or to diverge.

Whenever the tubes are elevated or depressed the objectives at the distal ends must be adjusted for the vertical plane. For example, if the tubes are depressed 15° the objectives must be adjusted at 15° from the right angle to the long axis of the tubes. A small scale attached to each objective assures us of the proper position. It is to be borne in mind that if the plane of the objective remains at a right angle to the direction of the tube it will not be possible to determine the extent of the torsion from any change of plane of direction associated with convergence.

In determining the extent and direction of the torsion (we are not to confound *torsion* with *declination;* as above stated they are conditions of a totally different character) we must first know the adjustment of the eyes in respect to anophoria or katophoria, for if the plane of regard of the individual is naturally directed below the horizontal plane or above it, there will, of necessity be a modification of the extent of torsion.

Also, should there be declination of either or both eyes this condition must of course be added to or subtracted from the record of the clinoscope in making these technical examinations

when the plane of vision is directed up or down with convergence.

Let me repeat that, while the details of such examinations may appear to be complicated, they are, in fact, simple, yet, in order to make valuable observations, these details must be strictly observed.

FROZEN CARBON-DIOXIDE IN THE TREATMENT OF TRACHOMA, VERNAL CATARRH, AND PTERYGIUM.

By Dr. A. E. PRINCE, Springfield, Ill.

(With one figure in the text.)

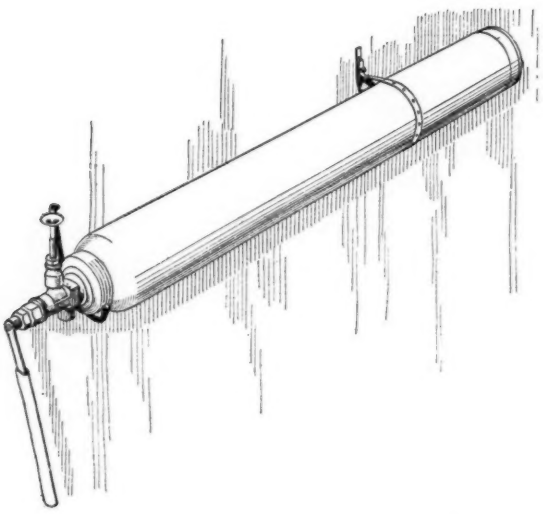
THE commencement of the use of this remedy was accidental, so far as the treatment of the eye was concerned. I first installed a tank for the treatment of epithelioma and nævus, as found in the vicinity of the eye, and having it, I naturally began to use it wherever it could be made available. The first case of trachoma for which I used the remedy was one of pannus which had resisted various forms of treatment. I made a very light touch to the conjunctiva of the lids, and, to my surprise, the patient responded to treatment so rapidly that in a very short time he was discharged cured. Following this case, I treated all trachomas with the carbon-dioxide ice, but not to the exclusion of other remedies. For this reason, my experience up to May, 1915, is of little scientific value, other than the development of the technic, which I want to describe with the hope that the readers of this journal will find it as satisfactory to them as it has proved to be to me.

Previous to the above period, I had resorted to squeezing, massage, grattage, scarification, copper sulphate, silver nitrate, tannic acid, etc., as seemed indicated. While I was convinced of the merit of the carbon-dioxide treatment, my evidence was of such a nature that it would have been thrown out of a court of scientific medicine.

How to Obtain the Ice: First, secure a tank of liquid carbon-dioxide, which is furnished to all vendors of sodawater and beer,—not the expensive outfit which is on the market;

the tank is usually supplied without charge, and the liquid contents is paid for as used, at the rate of two dollars and a half for a full tank. If the valve leaks, or the tank becomes empty from any cause, you have but to telephone to the bottling works, and a full tank will be at your service in a short time.

Have a blacksmith make a couple of hooks which will suspend this tank on the wall of your office or operating room,



in a manner shown in above figure. The outlet should be eight inches below the base to insure the escape of the liquid, and not the gas. When the gas comes freely without the formation of a snow, you may know that your tank is almost empty. You may still be able to secure sufficient for a treatment, in an emergency, by raising the base of the tank.

Have a plumber reduce a half-inch nipple to fit the smaller end of a large flaring ear speculum, and attach this with a pipe wrench to the outlet of the tank.

Place a piece of chamois skin over the ear speculum, and over this a napkin or towel to furnish support to the skin, which enables one to make the snow form under considerable

pressure; press the napkin down by a firm grasp of the hand, and simultaneously open the valve which permits the liquid to escape into the speculum, from which it will evaporate through the chamois skin, with the result that a cast of very dense snow will fill the bowl of the speculum. The density of this snow may be regulated by the time at which you close the valve. It is not desirable to obtain the greatest degree of density if one wishes to mold this cast to any particular shape. If it is too hard, it breaks under the pressure, and must then be made to conform to the shape desired by cutting it with a knife. The cast of the carbon-dioxide, when removed from the chamois skin, is absolutely white, and of a temperature about 110° below zero F. While still surrounded by the skin, press the snow between the fingers, as in making a cigarette, and it will gradually yield to the formation of almost any desired shape. The most favorable shape for the treatment of trachoma is that of a flattened olive. It is now ready to apply to the affected surface of the conjunctiva.

Cocainization: Make a 20% standard solution of cocaine muriate, by dissolving the cocaine in a standard solution of adrenalin chloride (1:1000). By diluting some of this with water, make a 10% solution, and apply it with a cotton-tipped probe, which should be passed into the upper fornix; sufficient will drain into the lower fornix. If the individual is hypersensitive, or not especially susceptible to the analgesic effects of cocaine, it is desirable to make a 2% solution by further dilution, and inject this under the conjunctiva. By proceeding in this manner, both solutions will contain the proper amount of adrenalin to prevent the constitutional effects of the cocaine, and the entire conjunctival area will be effectually cocainized. The hypodermic injection may not always be required, but timid and sensitive individuals are often met with who would rebel against a second treatment, provided the first application of the ice gave rise to great discomfort.

General Anæsthesia: In the case of children, it is very desirable to make the application absolutely painless. To this end, it is my practice to resort to the administration of a hypodermic injection of hyoscin and morphine. Considerable has been written on the adverse side of the use of scopolamin in the field of obstetrics, but I am sure that this does not apply

to the field of the ophthalmologist or the rhinologist. I employ this form of anæsthesia several times a day in operations on the nose, and for the removal of tonsils, and also as a preparation for the removal of cataract, and in the operations for strabismus. In the case of timid children, it is incontestable that a child loses all dread of the operation, and all recollection of what would be remembered as disagreeable, provided he has had a proportionate dose of morphin and scopolamin administered half an hour before the operation. This fortified with cocaine as above described, will often result in the patient not having any knowledge of the operation of squeezing or freezing, even though the operation may have been very thoroughly performed.

In a very few instances, I resort to chloroform—in the case of extremely hypersensitive or timid children. I inject ¼ gr. morphin and $\frac{1}{100}$ gr. hyoscin for a person weighing one hundred and fifty pounds. The only adverse symptom is delirium, which is antidoted by an injection of $\frac{1}{20}$ grain apomorphia. This usually does not produce vomiting or even nausea, but seems to control the mental excitement.

Application: In the treatment of trachoma, the ice is applied to the area in which the germs are expected to exist, for a period of two seconds. I originally recommended three seconds, but in working out the problem in the Feeble-Minded Institution at Lincoln, three seconds caused a slight sloughing of the conjunctiva. It never has done so in my hands. Secondly, I think the pressure must have been too great. I do not think, however, that two seconds will cause any sloughing at all, but would freeze the germs, and also the blood-vessels and their contents to a depth which would not interfere with nutrition. Third, there should not be a slough, and we do not have any sloughing in the application I make to the conjunctiva. The conjunctiva at first appears reddened, as the result of the reaction from the treatment. In a week, however, it appears more anæmic than it did before, owing, in all probability, to the destruction of some of the blood-vessels. There is no shrinkage following the treatment, and no apparent injury. There is no sloughing, and nothing is cast off, as is the case in the treatment of malignant growths.

Very few patients complain of the treatment. There is only

one application made to each point in the conjunctiva. Some applications may overlap. The indications for repeating the applications is the appearance of new granulations, or swollen folds in the fornix or swollen condition of the caruncle.

There are naturally a great many cases which have a minor degree of trouble, which can be treated by simply applying the cocaine, and applying the ice to some particular portion of the conjunctiva; especially is this so after the case has had one thorough treatment by squeezing and freezing. Sometimes one treatment may be sufficient, and at other times an occasional light treatment may be indicated, in which event each operator will be guided by the supreme law of common sense.

I am led to believe that freezing kills the germs and cures the disease; but that it is illogical to depend on the freezing to remove the adventitious tissue which may be so much more readily removed by surgical intervention.

Writer's method in case of general trachoma:

(a) Invert the upper lid and pass a trachoma forceps into the retrotarsal fold; elevate the forceps, thereby exposing the entire fornix; apply the ice. See that each field of the exposed area is frozen for two seconds. (b) Draw down the lower lid and freeze the lower cul-de-sac. (c) Trim the ice with a knife to a shape which will permit of freezing the caruncle and plica semilunaris and also the conjunctiva protected by the external commissure. Subject these areas to an exposure of two seconds.

The following is a good illustration of the practical management of a very bad case.

CASE I.—Fred Prichett, Petersburg, Ill., ten years of age, referred by Dr. Wilkens of Petersburg, was brought to me on February 11, 1915. He had trachomatous pannus and photophobia, and was unable to see his way. Mother reported that he had been a sufferer with sore eyes since he was three years old, during which time he had various kinds of treatment, some of which were temporarily beneficial. During the past eleven months, he had been treated by one of the ablest oculists in Central Illinois. The granulations were squeezed out, and he was seen at frequent intervals for eleven months.

When he was brought to me, it was impossible to do anything for him, or even to make a satisfactory inspection,

for which reason I gave him chloroform, squeezed out all the follicles that could be seen, made a canthoplasty, and froze the entire area of the conjunctiva. They were very poor people, and unable to remain for treatment, and returned home the same day with instructions to bathe the eyes with a lotion of carbolic acid, and return in a week. At the end of the week, he returned with head up, photophobia disappeared, and vision so improved that he could find his way anywhere. I regret that I repeated the application of the ice, for it is my conviction that it was unnecessary, and that it was my first treatment which cured him. I have seen him several times since, and there has been no tendency to relapse during the period, which is now one year.

The following is another case that illustrates the efficiency of the freezing method, after surgical procedure.

Case 2.—Donald France, of Danville, Illinois, was sent to me by a number of interested women, on April, 15, 1915. The boy had been unable to earn a living on account of the photophobia which was due to trachoma and pannus. The report was brought to me that he had been treated in vain, and that he had recently consulted one of the best oculists of Danville, who told him that his case would require daily treatment at the office for a year. Making due allowance for misrepresentation, I determined to test the efficiency of the ice in his case. Accordingly, I scarified the conjunctiva, and froze the entire surface thoroughly. I kept him in the sanitarium for one week, after which he was sent home, with the request that he return on May 18th, in order that I might be able to demonstrate the effect of one freezing, at the meeting of the Eye, Ear, Nose, and Throat Section of the Illinois State Medical Society. Upon his return, the lids were smooth, the congestion gone, and the cornea clear. He was fitted with glasses, and is now employed as an apprentice in a newspaper office.

Extermination of Trachoma from Institutions: While most of my experience has been confined to the treatment of individual cases of trachoma, I have had an opportunity to observe the effect of carbon-dioxide ice as applied to the elimination of trachoma in one institution. The Odd Fellows Orphans' Home is situated at Lincoln, Illinois, and has one hundred and fifty children of school age. For a number of years I noticed that the cases of trachoma were becoming more frequent, notwithstanding the efforts that were made to exercise precautions to prevent the spread of the infection,

by running water in the wash rooms, quarantine of the cases while the disease was active, and the energetic treatment and continuous treatment of all cases which indicated any form of conjunctivitis.

A year ago I advised the superintendent to have all the cases which gave any indication of the presence of trachoma sent to me for squeezing and freezing, and since that time the suggestion has been carried out in every case. It has not been necessary to keep these cases more than a few days, after which they were allowed to return to the institution. During this period, but one new case has been observed, whereas, before this period, there were one or two new cases a month. The one new case which developed was given a thorough treatment, returned to the institution, and made a quick recovery.

Recently I made inquiry of the superintendent of the institution to discover the presence of trachoma, and no new cases were reported.

It may be of general interest to record the local treatment which was followed after the freezing, as it might be inferred that it was not fair to attribute the good results to the freezing alone; neither do I wish to convey this impression for it is always in my mind that it is so important to cure the patient, and rid the institution of the disease, that I have, with the exception of certain selected cases to be referred to later, always given the patients the benefits of the best possible home treatment after they passed from my personal observation. The treatment referred to is embodied in the following:

Acid. tannici	2.
Cupri sulphatis	0.5
Phenol	0.5
Glycerin q. s. ad.	100.

M. Sig. Apply to the inverted lid twice a day.

This treatment was followed for several years before the freezing was commenced, in view of which it may be just to infer that considerable of the credit is to be attributed to the process of freezing.

In the following case, freezing was *unaccompanied* by treatment or operation, and demonstrates what may be accomplished.

CASE 3.—Miss Eula Carroll, Pike County, Illinois. Had been a sufferer for several years, during which she had had treatment by several physicians, with the final result that one eye was almost blind with pannus. Vision was $\frac{1}{200}$. It was impossible to see the pupil, except at the nasal side of the cornea. This case came to me after I decided to try the effect of freezing without the preliminary squeezing. Accordingly, I froze the conjunctiva of this worst eye three times, and tested her at the expiration of a week. Her vision at that time was $\frac{8}{200}$, showing a gain of eight hundred per cent. in a week, without any other treatment except that of ice compresses. By continuing the freezing once a week, she was cured in two months. The left eye was slightly affected, there being a single fold of conjunctiva in the lower fornix. This was obliterated as the result of two freezings, and she returned home with as good-looking eyes as one would wish to see. I am convinced that the period of treatment could have been reduced one half, had I removed all the trachomatous material at once by some surgical means, and frozen the tissues at the same sitting.

CASE 4.—Mr. Foster, coal miner, age about twenty-five years, was sent to me by the miners' union—on account of being absolutely unable to do a day's work. He had pannus crassus, trachomatous masses, extreme photophobia, and partial ptosis. He had been under treatment in the past at various times, with only slight benefit. I decided to give him no treatment other than the application of ice as above described, and a weak solution of tannic acid as a placebo adjuvant.

The eyes at first were very sensitive, and not very susceptible to the cocaine. The treatment was repeated twice a week, the interval being allowed for recovery from the reaction, which varies considerably in individual cases. The improvement continued uniformly, and he went home after six weeks absolutely free from pannus; no photophobia, and with his head erect. I am convinced that there was a loss of about three weeks of time on account of not having removed the granulations at the commencement of the treatment.

My observation of this and the preceding case leads me to believe that the action of the ice does two things: it destroys certain blood cells, and obstructs the capillary circulation, in consequence of which the conjunctiva appears more anæmic after recovery from the direct congestion resulting from the application. It destroys the vitality of low-grade pathological

tissue, while it meets more resistance in the effort to destroy physiological tissue or hyperplastic tissue.

I never had occasion to apply the ice directly to the cornea for pannus. The treatment of the lids seems to be quite sufficient to clear off the pannus, as in the case I cited of the girl who had vision $\frac{1}{200}$ and in one week vision was $\frac{8}{200}$. The pannus cleared away in a comparatively short time without touching the cornea at all.

Pterygium: I have treated all my cases of pterygium for about two months by freezing them. In every case the patient was delighted on account of the improvement in vision. The vascularity of the pterygium was destroyed, but it did not remove the adventitious tissue, in consequence of which I had to remove the pterygium in order to clear the cornea of adventitious tissue. However, after removing the pterygium, I have applied the ice to the area, at the time, and again two weeks after operation, as a safeguard against the return. In this application to the surface of the cornea, I have limited the application to a period of one second, and no discomfort has been experienced after an hour or two, during which period the patient applies hot compresses.

Freezing for Conjunctivitis. CASE 5.—Clarence Markwell, Springfield, Ill. Age nine years. To emphasize the use of ice in doubtful case. Diagnosis; follicular conjunctivitis. May have been trachoma.

Treatment had been zinc. sulph. and argyrol. Result was unsatisfactory, since no improvement had been obtained during a period of two months. No smear. Carbon dioxide applied once.

In the absence of my partner, I was called to see this case, and was struck with the appearance of the follicles, which constituted a fold of the lower lid, and I said to the mother that I would like to try the effect of freezing the germs to ascertain whether they were proof against a temperature of one hundred degrees below zero. There being no objection, I applied cocaine, everted the lids, and froze them thoroughly. He was told to continue the treatment under Dr. Penick the same as before. After two weeks, he was brought to me to observe the improvement. There were no follicles or excessive folds in the lower fornix; he could bear the light, and was not troubled with mucus or a sense of scratching, which had annoyed him so greatly before the application of ice.

Reduction of Swelling: In one case of trachoma which had been under my care for some months, I was annoyed by the persistence of the swelling of the conjunctiva of the lower fornix in spite of various kinds of treatment. After the first thorough freezing, the swelling and congestion disappeared.

In another case in which persistent swelling remained after recovery was otherwise complete, following an infection by gonococcus, I was led to try the effect of freezing, and the result was prompt and satisfactory.

Vernal Catarrh: It has fallen to my lot to treat two cases of vernal catarrh with carbon-dioxide ice, and the results are such as led me to believe that good may be expected from the remedy in this obstinate condition.

CASE 6.—Ralph Ziegler, Danville, Ill., age ten years. Had been under treatment for trachoma for a year. He had a typical case of vernal catarrh with the coxcomb nodules, secretion, and photophobia. He was usually worse in the morning, and always better on cool days. When he was brought to me, he could not bear the light. I gave him chloroform, burned out the nodules with the galvano-cautery, and froze the entire surface of the conjunctiva. On the following day, he awakened free from the distress that had been attributed to the presence of the mucus. I kept him under observation for a week, after which he returned to his home, and I have seen him twice during the past two months, and no sign of return has manifested itself.

The other case consulted me in the heat of summer, and the distressing feature was the presence of a ring of swelling about the cornea, together with extreme photophobia. He had the characteristic nodules on the lids, which I removed by the galvano-cautery, and followed by freezing with the carbon-dioxide ice. He was given a solution of tannic acid, and told to bathe his eyes in salt water several times a day. I saw him in September, after a period of two months, and the distressing symptoms had not recurred.

In these cases I am at a loss to know how much to attribute to the galvano-cautery, and how much to the carbon-dioxide ice, for the reason that I had a case before I became acquainted with the ice, which had the typical appearance of vernal catarrh which yielded promptly to the treatment with the galvano-cautery.

THE LOCALIZATION OF STREPTOCOCCI IN THE EYE.[1]

A Study of Experimental Iridocyclitis in Rabbits.

By E. V. L. BROWN, M.D., ERNEST E. IRONS, M.D., and W. H. NADLER, M.D., Chicago.

(*With eight photographs on Text-Plates VII.–X.*)

THE metastatic origin of lesions of the eye, such as panophthalmitis in streptococcal or pneumococcal sepsis, has long been clearly recognized, and the metastatic origin of similar or less severe lesions of the eye in patients in whom the other symptoms of bacterial invasion are slight or absent, or confined to some focus elsewhere in the body, is now being recognized in an increasing proportion of cases.

The argument for the bacterial origin of such lesions of the eye is strengthened by the occurrence in some patients of a preceding or coincident arthritis, in the course of which the presence of bacteria can be demonstrated in the joints, and sometimes in the blood. Stock[2] and others have produced iridocyclitis in animals by intravenous injections of bacteria.

Recently Rosenow[3] has noted iridocyclitis in a number of animals, chiefly rabbits, following the intravenous injections of streptococci and other organisms derived from various lesions of man and animals.

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[1] Presented to the Chicago Society of Internal Medicine, December 27, 1915. The paper published herewith is an abridgment of the full article published in the *Journal of Infectious Diseases*, March, 1916.

[2] Stock, "Ueber experimentelle Veraenderungen an den Augen des Kaninchens durch Blutinfektion mit pathogener Hefe," 34, *Heidelberger ophth. Ges.*, p. 261, 1907.

[3] *Journal Infectious Diseases*, 1915, xvii., p. 403.

While we believe with Rosenow that the localization of organisms (streptococci) in the eyes (uveal tract) of rabbits in his experiments probably was due in part to peculiarities of the organisms themselves, we recognize the justice of the argument of those who would maintain that, on the theory of probabilities, bacterial embolism of vessels of the eye may be expected in a certain proportion of animals in which large amounts of organisms are introduced by intravenous injection.

It might further be urged in support of this accident theory that in the same animals in which lesions of the eye occurred Rosenow found lesions of other organs (of 48 animals showing eye lesions, 28 showed arthritis, 5 hemorrhages in the appendix, 8 ulcers of the stomach, 10 lesions of endocardium, 8 of the pericardium, 19 of muscles and fascia, and 12 of the kidneys), indicating a widespread bacterial invasion. Furthermore, these animals were individuals selected from several hundred similarly inoculated animals.

If, however, as Rosenow points out, the sources of the cultures used for these injections are considered, it appears that lesions of the eye were more often observed in animals which received cultures of organisms derived from patients suffering from arthritis, myositis, etc., and rarely in animals which were injected with cultures from appendicitis, ulcer of the stomach, or cholecystitis. The source of the cultures, therefore, seems to have been an important factor in determining the percentage of lesions of the eye following intravenous injection.

The following experiments were made with the idea of tracing the changes in the power of an organism (streptococcus) which presumably had already given rise to iridocyclitis in a patient to produce similar lesions in animals, after varying periods of residence in the original host, of residence in animal tissues, and of growth on culture media.

The accessibility to observation of lesions of the eye greatly facilitates studies of this sort. The exact time of appearance of the lesions and their course can be more readily noted than when similar studies of lesions in joints or other organs are made. Minor lesions which might escape notice or disappear before the death of the animal, when they involve joints or internal organs, are more easily detected in the eye.

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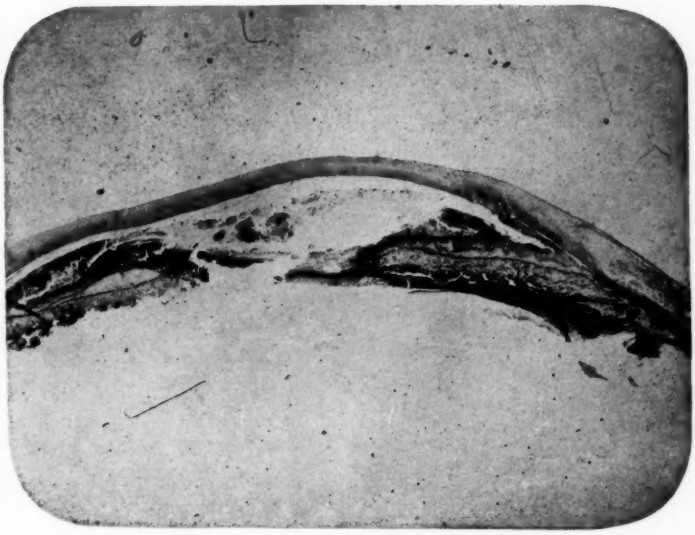

FIG. 1.—RABBIT 3.
Severe suppurative iridocyclitis, three days after intravenous injection of streptococci from patient. Magn. x 10.

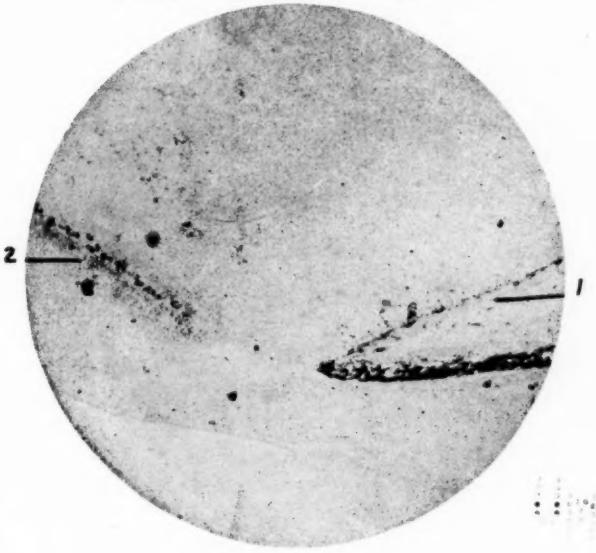

FIG. 2.—RABBIT 1.
Early stage of iridocyclitis; animal killed five days after inoculation. Magn. x 60.

The patient, J. S., æt. 40, single, white, waiter, was admitted to the Cook County Hospital, April 19, 1915. Eight days ago the patient "caught cold" and his left tear sac became swollen. Three days ago it was opened at a neighboring dispensary. There has been pain in the left side of the head since onset of the eye trouble.

Following an operation on his nose for the relief of some suppurative process involving the septum, twenty years ago, the left eye "watered" for years, and he has been able to "press pus" out of the corner of his eye for two or three days at a time at intervals of five or six months ever since. The sac region was never swollen and tender until eight days ago.

About twelve days before admission an eruption appeared in an irregular band in the region of the right ninth and tenth ribs (herpes zoster). This was not accompanied by any marked systemic disturbance.

Aside from these lesions and measles, whooping cough, and mumps in childhood, the patient has suffered no severe illnesses. He had gonorrhea twelve years ago but this healed without observed complications. He denies syphilitic infection, is a moderate smoker of tobacco, and takes alcoholics freely at times. One brother died of tuberculosis; four sisters and one brother are living and well. The patient's general health is good, appetite fair, bowels constipated at present, urination free.

The patient is a well-developed white man, apparently not very ill. The scalp, skull, and ears appear normal. The nose shows an old scar over the bridge, the septum is short, and the end of the nose depressed. The tongue is coated, tonsils enlarged and show some hyperæmia. The teeth are carious; radiographs show three alveolar abscesses; affected roots extracted by Dr. Puterbaugh. The sinuses on admission are normal clinically (Dr. Friedberg) and radiographs show normal densities (Dr. Blaine). Later the left antrum filled with pus by direct extension from tear sac following operation.

A number of healing lesions of the skin extend in a band around the chest from mid-sternum to the spine on right side at the level of eighth to tenth ribs (herpes zoster). The lungs, heart, abdominal viscera, and reflexes appear normal. The toes of left foot are deformed (old injury). No other joint lesions. Prostate moderately enlarged; consistence uniform, not hard nor tender.

Throughout the course of illness there was very little constitutional disturbance and the temperature did not rise above 99.2 degrees F.

Wassermann and gonococcal complement fixation were

negative. Urine normal. Tuberculin tests made after subsidence of iritis were negative after one and four milligrams, subcutaneously.

Blood cultures on April 28th (seventeen days after onset of iritis) and on May 28th, made on plates, in tall dextrose agar tubes, and in ascites dextrose broth, gave no growth.

Cultures from tear sac, April 28th, contained many streptococci and a few colonies of a white staphylococcus. The streptococcus grew in long chains, produced a wide zone of hæmolysis, fermented dextrose, lactose, saccharose, and salicin, but not raffinose, mannite, or inulin.

Cultures from the tear sac on six subsequent occasions gave approximately the same relative numbers of streptococci and staphylococci.

Smears from the tonsils show streptococci with a smaller number of gram negative diplococci. This streptococcus (str. viridans) produces small green, non-hæmolytic colonies on blood agar. Dextrose, saccharose, lactose, and raffinose are fermented, but not salicin, mannite, or inulin. Two rabbits injected intravenously with cultures direct from tonsils showed no lesions of the eyes. One rabbit showed a flaccid paralysis of the hind legs within two hours after injection and died the following day. There was a large infarct of the lung with multiple small infarcts and subpleural hemorrhages, two small subendocardial hemorrhages, injection of vessels of pia with multiple hemorrhages almost continuous in the lower half of the cord. The second rabbit survived for three weeks without symptoms. No anatomical cause of death was found; a gram positive bacillus was isolated from the heart's blood.

The region of the left tear sac is much swollen, the skin over it red, tense, and tender. Large quantities of pus can be expressed. The left eye shows marked ciliary and conjunctival injection. A long, narrow, slightly raised epithelial vesicle runs along the entire margin of the upper inner corneal limbus; a shorter one lies just inside the lower outer limbus. The stroma beneath is distinctly furrowed out. Temporal to the upper furrow the marginal stroma is superficially vascularized for a width of 1*mm* along the limbus between 12 and 2.30 o'clock. The cornea is otherwise clear. The iris has a greenish discoloration (fellow iris blue). The pupil dilates ad maximum up and in, less well upward and outward and least well down and inward. Posterior synechiæ involving all layers of the iris are found at 8 and 5 o'clock, and the pupil border is straight from 3 to 6 o'clock. There is no definite pupillary exudate but the disk is seen hazily.

The conjunctiva of the right eye is somewhat injected,

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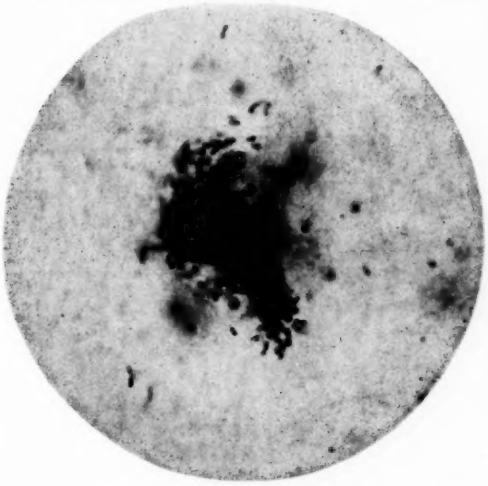

FIG. 3.—RABBIT I.
Leucocyte filled with streptococci. (From the line of cells lying across the pupillary space in Fig. 2.) Magn. x 1200.

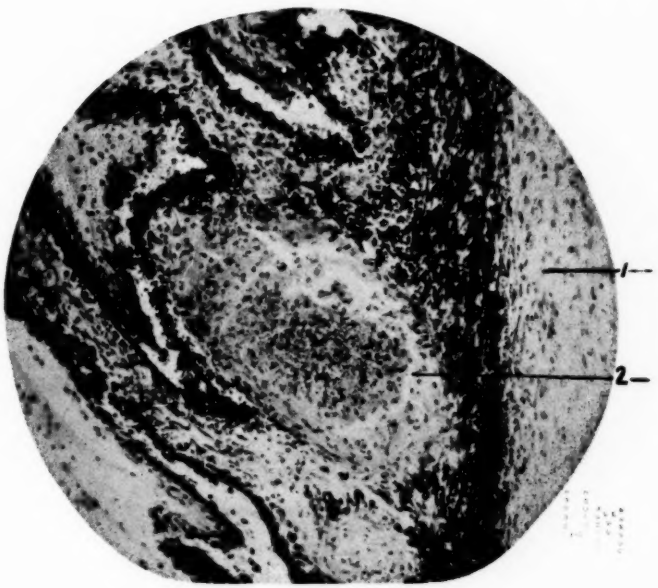

FIG. 4.—RABBIT I.
Abscess in the posterior part of the ciliary body. Magn. x 140.

the pupil is round, regular in outline, and reacts to light and accommodation.

Three weeks after admission the acute swelling of the tear sac had subsided and it was fully opened and drained May 7th (Dr. Clark). No necrosis of bone was found. In the fifth week the tear sac was again opened and drainage into the nose effected. Some necrotic bone in region of ethmoid cells was found and curetted May 25th. The center of the nasal quadrant of the cornea now showed a yellowish white dot of infiltration located in the anterior stroma and measuring only $\frac{1}{2}mm$ in diameter. In the course of the next few days three or four other areas appeared nearby. At first they were merely vesicles, then they broke and tiny areas of gray infiltration appeared beneath the pitted surface. The limbal vesicles also collapsed down onto the furrowed-out stroma and all gradually healed, very much as phlyctenulæ do. Ciliary injection and conjunctival chemosis were quite marked. The pupil dilated well, but the iris remained greenish, considerably swollen, with markings blurred. Brown dots of detached iris pigment were found on the lens capsule.

In the eighth week the adjoining antrum, previously free of infection so far as could be determined clinically and by transillumination and radiographs, was found full of pus and connected directly with the tear sac. Antrum was drained through the nose. Bloody pus obtained by lavage (Dr. Friedberg). In the twelfth week the pus disappeared from both the tear sac and antrum; the iritis was relieved and did not return in ten weeks of subsequent observation.

THE PRODUCTION OF IRIDOCYCLITIS IN ANIMALS.

Cultures taken from the tear sac of the patient, after varying periods of growth on laboratory media, were injected intravenously in rabbits. For convenience of discussion, the animals have been divided into series, each series including the animals inoculated with cultures taken from the patient on the date indicated. The seven series, therefore, afford opportunity of studying changes in invasive power of the streptococcus with respect to the eye and other organs of rabbits after varying periods of residence in the human body.

Series I.—Four rabbits were injected intravenously with suspensions in salt solution of third and fourth subcultures on human blood agar of hæmolytic streptococcus isolated from the tear sac of patient on April 28th.

Iritis appeared in three of these rabbits (Rabbits 1, 3, 4).

Rabbit 1.—May 15th, intravenous injection of suspension from one twenty-four-hour blood agar slant (third subculture) of hæmolytic streptococcus from tear sac of patient.

May 19th, right eye red, watery, vessels injected, distinct conjunctivitis. Anterior chamber clouded. Dark iris of darker color than normal left. Iris thrown into radial folds. Exudate adherent to anterior surface of iris, floating over pupil; gives appearance as though squeezed from narrow tube.

Animal killed May 20th. No streptococci obtained in cultures from aqueous. Hæmolytic streptococci in cultures from heart's blood. No gross lesions of viscera.

Rabbit 3.—May 19th, intravenous injection of suspension of culture from twenty-four-hour blood agar slant transfer from culture used for Rabbit 1.

May 20th, eyes unchanged.

May 22d, severe inflammation in left eye, with conjunctival hemorrhages, ciliary injection, and hypopyon. Iris appears yellow and covered with exudate. Right eye normal. Rabbit killed with ether. Hæmolytic streptococci in cultures from purulent content of anterior chamber. Streptococci in cultures from joint; heart's blood sterile.

Rabbit 4.—May 19th, intravenous injection of suspension of one half blood agar slant transfer from culture used for Rabbit 1.

May 20th, eyes unchanged.

May 21st, alive but condition not recorded.

May 22d, found dead. Left eye: conjunctival hemorrhage, limbal vessels injected, palpebral conjunctiva red, hemorrhagic; iris not satisfactorily examined because of clouded cornea.

The clinical observations of this animal are hardly sufficient for a diagnosis of iridocyclitis. Sections, however, show a lesion of ciliary body, with many streptococci in the tissue of the corona ciliaris. Right eye normal. Streptococci in culture from knee joints. A small subendocardial hemorrhage; valves normal. No other gross visceral lesions. No herpes.

A suspension of fluid containing streptococci from the eye of Rabbit 3 was injected intravenously in Rabbit 7. No changes were observed in the eyes and the animal was discharged apparently well twenty-six days later. The number of streptococci injected was necessarily small. Pure cultures of streptococci from eye of Rabbit 3 (suspended in salt solution, amount equivalent to 3*cc* of eighteen-hour culture in ascites dextrose broth) were injected intravenously in Rabbits 8 and 9. No ocular lesions were produced.

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FIG. 5.—RABBIT 4.
Leucocytic mass in sinus angle. Magn. x 90.

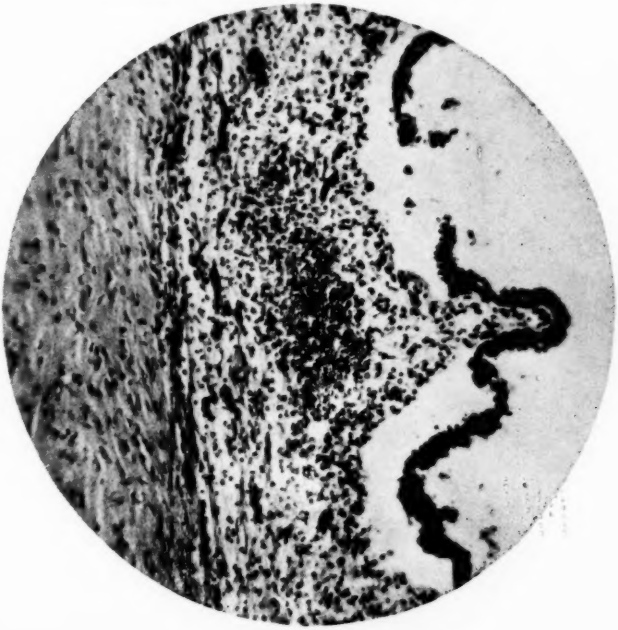

FIG. 6.—RABBIT 4.
Node from infiltration about a vein in the posterior part of the ciliary body. Magn. x 170.

Series II.—Cultures from patient May 24th. At this time the iritis was worse than for some days previously. Severe inflammation in tear sac.

Four rabbits (10, 11, 12, 13) were injected with suspensions of twenty-hour ascites dextrose broth cultures inoculated directly from the patient. These cultures contained a small number of staphylococci in addition to the predominating streptococci. *Rabbit 11* died four days later without evidence of iritis; no clearly marked focal lesions in the viscera; cultures from the heart's blood and from joints showed streptococci.

Rabbit 13 showed no iritis for four days; was found dead on the fifth day; the media of the left eye were more cloudy than usual, but stained sections showed no evidence of iritis. Large pulmonary infarct.

Rabbits 10 and 12 developed definite iritis.

Rabbit 10. May 25th, received suspension of organisms from 5*cc* ascites dextrose broth culture. After twenty-four hours, conjunctivitis in right eye. The iris is dull diffuse red in color. Four hours later conjunctivitis more marked, œdema of lids with lacrimation, ciliary injection, "iris covered with spots of exudate"; the color of iris is now more gray yellow. At twenty-eight hours, the aqueous is clouded. Left eye normal. Animal is lively. At forty-eight hours severe conjunctivitis, ciliary injection, chemosis. Iris beaded with exudate. Pupil partly obliterated by circular gray-white exudate adherent to iris margin. Spontaneous perforation at corneal margin and death fifty-two hours after inoculation. Exudate from anterior chamber contains gram positive cocci in chains; hæmolytic streptococci in cultures from anterior chamber, from heart's blood, and from knee joint. No herpes, no gross changes in muscles, appendix, intestine, liver, spleen, or kidney. Lungs show some œdema. Several small hemorrhages in stomach. One small subendocardial hemorrhage in right auricle, valves normal.

Rabbit 26.—On May 28th received suspension of streptococci (from 6*cc* twenty-four-hour culture ascites dextrose broth) isolated from eye of Rabbit 10. After twenty-four hours, the left eye showed slight lacrimation, with injection of conjunctival vessels, marked ciliary injection, and cloudy aqueous. The cornea perforated spontaneously seventy-two hours after inoculation, and animal was found dead on the fourth day. Streptococci in cultures from aqueous, heart's blood, and knee joint. No significant visceral lesions were found.

Rabbit 26a.—Inoculated with smaller amount of same culture as Rabbit 26; died on fourth day. No lesions of eye or viscera found. Streptococci in heart's blood.

Streptococci from *2cc* of eighteen-hour ascites dextrose broth culture from eye of Rabbit 26 were injected intravenously in four rabbits (40, 41, 42, 43). One animal died after four days. Cultures from heart's blood, no streptococci. The other three rabbits were discharged well after fourteen days.

Streptococci from heart's blood of Rabbit 26 injected in two rabbits (37, 38) produced no definite lesions of eyes. In one animal (37), dead on sixth day, the vessels of left nictitating membrane were more prominent (probably due to position of animal after death). Joint fluid cloudy; colon bacillus isolated. No streptococci in heart's blood. Rabbit 38 developed severe arthritis but survived. Killed with chloroform eight weeks after inoculation. Cultures from heart's blood and joints remained sterile. No visceral lesions except moderate coccidiosis of liver.

Rabbit 12. Received suspension of streptococci from *5cc* twenty-hour ascites dextrose broth culture on May 25th. After forty-eight hours eyes appeared normal, but after seventy-two hours the left eye was inflamed, with marked conjunctivitis, chemosis, and lacrimation. The iris (normally brown) appeared hazy, gray-yellow in color with an adherent exudate; hypopyon, with perforation, followed by ocular hemorrhage and death of animal on fifth day.

There were found a few small hemorrhages in mucosa of stomach, and subendocardial hemorrhage (*2mm* diameter) right auricle. No other gross visceral lesions.

Cultures from within left eye showed hæmolytic streptococci. Streptococci in cultures from heart's blood. Sections showed inflammation of ciliary body with exudate and masses of streptococci in anterior chamber.

Four rabbits (33, 34, 35, 36) received suspensions of pure culture of hæmolytic streptococcus from eye of Rabbit 12.

Rabbit 36.—The left conjunctiva was injected and some lacrimation twenty-four hours after injection. Animal found dead on second day. Anterior chamber was cloudy (possibly post-mortem change). Cultures from heart's blood and from left knee joint showed streptococci.

Rabbits 33, 34, 35, died after one, seven, and sixteen days; streptococci in cultures from heart's blood of 33, 34, and from knee joint of 33.

Rabbits 16 and 17, injected with third transfer in culture from patient, showed no lesions of the eyes.

Series III.—Cultures taken May 26th from tear sac of patient, following curettage and packing four hours previously, contained hæmolytic streptococci and few staphylococci. To avoid as far as possible changes in organisms

ILLUSTRATING DOCTORS BROWN, IRONS, AND NADLER'S ARTICLE ON "THE LOCALIZATION OF STREPTOCOCCI IN THE EYE."

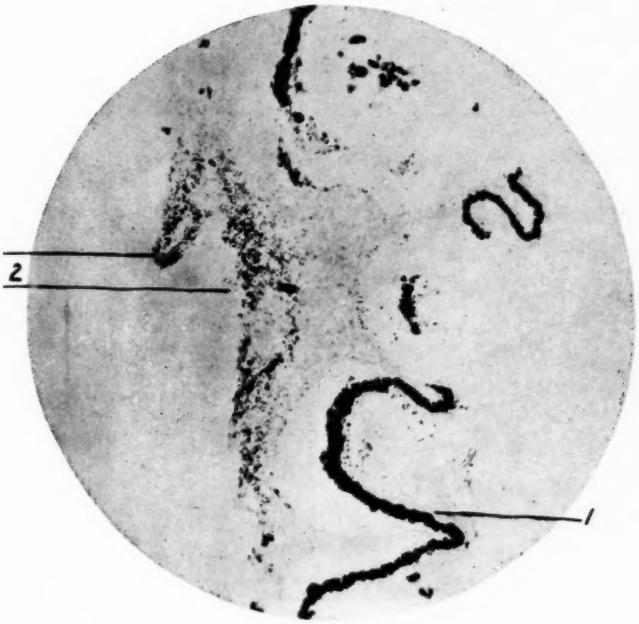

FIG. 7.—RABBIT 4.

Masses of streptococci in the ciliary body. Gram-Weigert. Magn. x 170.

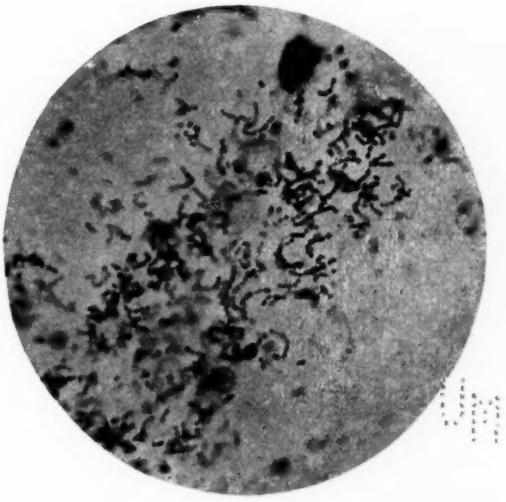

FIG. 8.—RABBIT 4.

Streptococci from the area marked "*2*" in Fig. 7. Magn. x 1200.

during the period of subculture, the original broth cultures containing staphylococci, together with streptococci, were centrifuged and animals injected with sedimented organisms within twenty-four hours after removal from patient.

Two rabbits (18, 19) died after twelve and eleven days. No ocular lesions.

Series IV.—Cultures taken May 28th from tear sac are similar to those of Series III.

Two rabbits (30, 31) died after three and fifteen days. No ocular lesions. Streptococci in joint of Rabbit 30.

Series V.—Cultures taken June 2d from tear duct contain chiefly hæmolytic streptococci, with a few staphylococci.

Four rabbits (44, 45, 46, 47) were injected with pure cultures of the streptococci. Two survived without lesions of eyes (49, 50). In Rabbit 51, there was no visible lesion of eye on second day; on third day animal found dead. Conjunctiva of left eye moderately injected, with some exudate, but no clearly defined lesion of bulb; probably post-mortem change or from terminal struggles. Sections show no lesions of uveal tract. Cultures from turbid joint fluid contain streptococci. Rabbit 48 died on fifteenth day without ocular lesions.

Series VI.—Cultures from tear sac June 7th. Almost pure culture hæmolytic streptococcus.

Six rabbits (55–60) injected with these cultures showed no lesions of the eye.

Series VII.—Cultures from tear sac June 16th. Streptococci and few staphylococci.

Four rabbits (81–84) were injected with doses corresponding as nearly as possible to those given to rabbits in Series II. Three of the four succumbed within three days, and hæmolytic streptococci were isolated from heart's blood of each. The virulence of the streptococcus for rabbits seemed not appreciably decreased but no definite lesions of the eyes were produced. A transient conjunctivitis with discharge was noted in the left eye of Rabbit 81, but such slight lesions were occasionally noted in uninoculated animals.

ANATOMIC STUDY OF THE RABBITS' EYES.

As noted, four rabbits were injected intravenously with the pure cultures of the hæmolytic streptococcus obtained from the acutely inflamed tear sac of the patient on April 28, 1915;

three of these rabbits developed iritis. Similarly, two of four rabbits gave positive results with material obtained twenty-six days later (Series II.). Four of these animals of Series I and II showed clinical and anatomical suppurative iridocyclitis; in the remaining rabbit (No. 4) the lesion did not reach the suppurative stage before death of the animal. The streptococcus was found inside all of the affected eyes and not in the fellow eyes.

Rabbit 3 of the first series is typical.

Upon section the episclera is found much infiltrated and the sclera at the sulcus permeated by cells through all layers.

The corneal epithelium is absent for the most part and where present at all is reduced to one or two layers. The anterior two thirds of the stroma is moderately infiltrated with leucocytes, the posterior third is necrotic. Descemet's membrane is everywhere denuded of its endothelium.

The iris and ciliary body are much swollen and densely infiltrated with cells and fibrin. This exudate breaks through the ciliary processes and the posterior layers of the iris, fills out the posterior chamber, throws the ciliary processes forward, mats them together, and binds both the corona and the iris to the lens capsule, blocks the pupil completely, and extends over the iris through the lateral thirds of the anterior chamber (Fig. 1). The central pupillary third of the anterior chamber is occupied by a fibrin clot. The spaces of Fontana are distended and the posterior end of Descemet's membrane is separated from the stroma by leucocytes. The exudate continues back behind the root of the iris between the ciliary body and the sclera to the beginning of the choroidea. The choroidea itself is little invaded and the retina not at all.

The process is therefore a severe suppurative iridocyclitis.

A similar but less severe iridocyclitis was found in Rabbit 1. It evidently represents an earlier stage of the process, and the disposition of the organisms in the tissues can be better studied than in the severer type.

There is a sharp line of demarkation between the fibrinous clot occupying the central third of the anterior chamber and the cellular exudate which lies over the iris on each side of the pupil. Between the two one finds an almost unbroken string of leucocytic clumps, so filled with organisms that in Gram-Weigert sections they make a blue line running from

the pupillary border to a point halfway between the center and the base of the cornea on each side (Figs. 2 and 3). In front of the line the fibrin clot is almost, if not entirely, devoid of cocci, but behind it the exudate is everywhere richly permeated with chains and groups of streptococci. The iris itself is only moderately infiltrated, much less so than the ciliary processes, and no organisms are found in the iris. Other sections show two fairly large abscesses in the posterior portion of the ciliary body, just external to the line of the bases of the processes (Fig. 4). The abscesses contain no visible organisms. The exudate between the ciliary processes contains large numbers of cocci, yet they are much less numerous than in front of the iris. In contrast to conditions found in the iris numerous organisms can be found within the stroma of the ciliary processes, about the vessels, among the infiltrating cells, and between the cells making up the layers of its unpigmented and pigmented epithelium. No organisms can be found in the infiltrate blocking the spaces of Fontana and the ligamentum pectinatum, or lying outside the ciliary body. The origin of the great mass of both the leucocytes and the organisms seems, therefore, to be in the ciliary body rather than in the iris.

Rabbit 4 showed the earlier changes produced by the invading organism. Some sections show a fibrin clot and a large leucocytic node in one sinus angle (Fig. 5). This mass of leucocytes can be followed well back through the ciliary body in successive sections to the posterior end of the corona ciliaris where it forms a node about a vein (Fig. 6). Gram-Weigert stains show many chains and clumps of streptococci free in tissue spaces throughout the ciliary body (Figs. 7 and 8).

Rabbit 12 of the second series showed a more extensive suppurative process with rupture of the sclera. Upon section a broad gaping defect in the sclera was found near the posterior end of the ciliary body, on one side, with hemorrhage and prolapse of the detached retina part way into the wound. The iris and ciliary body show very extensive infiltration, and the pupil and both chambers are choc-a-bloc with fibrin and dense leucocytic exudate. The iris and ciliary body are similar in appearance to that of Rabbit 3. The marginal thirds of the cornea are swollen to twice the normal thickness. There is an almost complete loss of corneal epithelium and considerable infiltration of the anterior third of the stroma. The region of the ligamentum pectinatum and canal of Schlemm shows a massive infiltration, extending halfway back to the ora serrata and detaching the ciliary body from the sclera. The iris is bound to the lens on one side by flat synechia and by synechia of the

pupillary border on the other side. The body of the iris on this side is thrown forward and its root adherent to the base of the cornea. The retina and choroidea are both normal.

Rabbit 10 showed essentially the same anatomic findings.

Rabbit 26 (inoculated with pure cultures obtained from the vitreous of Rabbit 10) showed a clinical suppurative iridocyclitis. Most of the eye was sacrificed for cultural purposes, but the organisms were found in sections of the uveal exudate.

Sections of the eyes from twenty other inoculated rabbits in which there were no clinical evidences of ocular inflammation were carefully examined for inflammatory lesions and bacteria, with negative results.

SUMMARY.

Hæmolytic streptococci isolated from the tear sac of the patient April 28th, during a period of acute iridocyclitis, produced iridocyclitis, with hypopyon and perforation of bulb in two of four rabbits, and a less marked lesion in a third (Series I.). These cultures were from the third and fourth transfers on blood agar slants. Cultures taken from the tear sac on May 24th during a period of exacerbation of the inflammation in eye and tear sac produced iridocyclitis in two of four rabbits. Cultures of hæmolytic streptococci taken from the tear sac on five subsequent occasions (May 26th to June 16th), during a period of continued improvement in condition of eye and tear sac of the patient, produced no lesions of the eye in a total of twenty-two rabbits. These cultures were inoculated either from the first transfer from the patient (in which case staphylococci were sometimes present) or from the second transfer in pure culture after isolation on blood agar plates.

The failure of the later cultures from the patient to produce iridocyclitis in rabbits did not seem to be associated with an appreciable decrease in virulence for rabbits. When equivalent quantities of streptococci were inoculated, animals in the later series died in about the same time as those of the earlier series, and hæmolytic streptococci were isolated usually from the heart's blood, and frequently from the joints. Other gross visceral lesions were not frequent, though small hemorrhages in the endocardium, pleura, and stomach, and infarcts of lung, were occasionally noted.

Cultures which had produced ocular lesions in rabbits and had then been kept in the incubator for ten days (two subcultures) no longer produced these lesions. The strain which produced iridocyclitis in Rabbits 1 and 3 was kept at 37 deg. C. for a few days and then placed in the ice-box. July 7th (fifty-two days after isolation) subcultures no longer produced ocular lesions in rabbits.

Attempts were made to produce lesions of the eye from rabbit to rabbit either by direct transfer of the exudate from the eye or by means of one intervening subculture. Thus, cultures of streptococcus from the eye of Rabbit 10, in which iridocyclitis had been produced by intravenous inoculations, were inoculated intravenously in Rabbit 26. Iridocyclitis was produced in this animal and hæmolytic streptococci were isolated from the eye and from the heart's blood, but inoculations of these cultures in turn in six more rabbits failed to produce any further iritis.

The power of the hæmolytic streptococcus in these experiments to localize in the eye and produce iridocyclitis in rabbits was lost in a relatively short time; (1) in the body of the original host (tear sac), (2) in cultures, and (3) during animal passage. This change in tissue localization seemed not to be associated with any demonstrable decrease in lethal power.

The hæmolytic properties and fermentative reactions in various sugar media of the streptococci from the tear sac were studied from time to time after growth on culture media and after successive passages through animals. The zone of hæmolysis on blood agar plates became somewhat smaller after two months' growth on culture media (blood agar). After six months the eleventh subculture showed no further decrease in the zone of hæmolysis.

When first isolated, cultures formed acid in media containing dextrose, saccharose, lactose, and salicin, but not in raffinose, mannite, and inulin. In later cultures (two months), mannite and raffinose were inconstantly fermented.

After passage through a rabbit (intraocular injection) the streptococcus was recovered in pure culture, and when placed in sugar media again gave the same reactions as when first isolated from the patient.

The failure of the later cultures to produce lesions in the eyes of rabbits did not appear to be accompanied by any constant alteration in fermentative power. Some decrease in hæmolytic power was noted.

ANILIN INJURIES OF THE EYE.

Report of a Case with Deep Ulceration of the Lower Lid.

By R. J. CURDY, M.D., Kansas City, Missouri.

MANY cases of injury of the eye by the anilin colors used in copying pencils have been reported, the severity of the injury varying from a mere temporary staining of the conjunctiva to perforating burns of the globe resulting in panophthalmitis and total loss of the eye. The case now reported is one showing the violently caustic action and deeply penetrating power of the basic anilin colors.

Sister N——, age thirty-three, a teacher, while sharpening a copying pencil, got a considerable quantity of the anilin dust in the lower conjunctival sac of the right eye. When seen about four hours later the conjunctiva of the entire lower lid was deeply stained, most intensely in the nasal half; the conjunctiva of the lower half of the globe was also colored, but less intensely. A few fine particles of the anilin remained undissolved and were removed. After five days the color had all disappeared, the conjunctiva of the globe remaining congested and swollen, and that of the lower lid red and raw, as from a burn. Two weeks later the conjunctiva of the lower lid still was red and raw, and was covered with a sloughing false membrane. Two days later the membrane became a white membranous discharge, the conjunctiva still red and swollen, and in the nasal half of the lid appeared a ragged, necrotic ulcer about 4*mm* in diameter, the surrounding tissue having the dead white color of necrosis, without apparent infection. During the next three weeks the ulcer increased in size to 8*mm* horizontally, and from the lid margin to the fornix, and retained its necrotic character without apparent infection. At this time, eight

weeks after the injury, the inflammation of the conjunctiva of the rest of the lid began to subside, the ulcer appeared clean, without necrotic tissue or discharge. The skin of both lids now showed redness and a few eczematous crusts. Four days later the ulcer was again discharging, and the skin of both lids more red and swollen, and with a vesicular eruption. This was strongly suggestive of some irritant application, but careful inquiry as to this possibility, was negative. From this time there was a gradual subsidence of inflammation with healing of the ulcer, the final result being a narrow symblepharon in the nasal half of the lower fornix, and cicatricial entropion of the nasal half of the lid. The other portions of the conjunctiva of the lid and globe recovered their normal condition. During all the period of inflammation, two months, there was much pain, at times preventing sleep. There was no disturbance of the cornea at any time. Operation was required on the symblepharon and the entropic lid, and finally, functionally normal conditions were obtained.

Of the cases reported of anilin injuries, many were trivial, the conspicuous staining being the only symptom, and this disappearing within a few days. Of the more serious cases the following may be cited:

Dunn (ARCH. OF OPH., xxxiv., page 120) reports two cases which resulted in panophthalmitis and required enucleation. In the first case, seen four days after the injury, the piece of anilin pencil point was found under the upper lid, partially dissolved. In the upper-inner quadrant of the ball was an area 2 x 10*mm* dead white as though the conjunctiva and adjacent sclera were necrotic. The inflammatory symptoms increased, the lids greatly swollen and stiff, the cornea clouded. Pain was intense and continued several days after enucleation. The second case was similar; the anilin pencil point was in the conjunctival sac four days. There was panophthalmitis with "terrible suffering."

Snell (*Ophthalmology*, vi., page 216) reports a case in which a piece of anilin pencil point 6*mm* long was removed from the lower conjunctival sac, leaving a ragged wound of the conjunctiva. The aqueous was stained with anilin, which gravitated to the bottom of the anterior chamber, resembling a hyphæmia. The inflammatory symptoms increased and there was much pain, but after two weeks all symptoms and signs

had disappeared except a little redness, and the vision was normal.

Tyson's (ARCH. OF OPH., xxx., page 77) patient was a boy five years old, who rubbed the conjunctiva of the lower lid with an anilin pencil. The lid became intensely swollen, with a hard mass the size of a cherry in the middle of the lid. The conjunctiva was stained and there was a "pigmented hypopyon of a greenish-brown metallic luster." A staphyloma of the lower portion of the cornea developed.

Haas (ARCH. OF OPH., xliv., page 345) removed a piece of anilin pencil which had been in the conjunctival sac two hours. Three days later there were several small marginal ulcers of the cornea which repaired within twenty-four hours, but others appeared elsewhere at the limbus, and after a few days whitish lines appeared in the substantia propria of the cornea, which lasted fifteen days, and disappeared entirely.

Kuwabara (ARCH. OF OPH., 1909, page 299) reports a case of perforating ulcer of the cornea resulting in staphyloma.

Brown (*Ophthalmology*, ix., page 367) reports an abrasion of the cornea with an anilin pencil, which developed into an ulcer. The ulcer healed in a short time.

The varying intensity of injury from anilin colors is due to difference of chemical composition. Dunn quotes Vogt (*Arch. d'opht.*, April, 1906) who made experiments of the action of anilin colors on the conjunctiva. "The application of small quantities of acid, neutral, or mordant anilin colors to the conjunctiva produces little or no inflammatory reaction. The application of equal quantities of basic colors causes violent inflammation, which may result in panophthalmitis. The different basic colors produce on the conjunctiva effects of varying intensity, the injuriousness increasing with the basicity of the colors." Haas reported chemical examination of the pencil point showing "rosanilin hexamethyl, a basic dye with histologic affinity for cellular nuclei, which explains the necrotic action."

Conspicuous in the course of these injuries are the long time during which the caustic action continues, and the late appearance of lesions. In the case reported by Haas, the original ulcers healed quickly, but later others developed, and also opaque streaks in the cornea, and these late lesions lasted

much longer than the first ones. In Dunn's case the inflammatory symptoms increased steadily for some time after removal of the piece of pencil point, and the intense pain continued several days after enucleation of the eyeball. In the case now reported marked inflammatory symptoms did not appear until three days after the injury, ulceration was not apparent until eighteen days, and it was eight weeks after the injury that the vesicular dermatitis of the lids appeared.

The treatment is the same as in other burns. Any remaining pieces or particles of anilin are, of course, removed. Tannic acid in ten per cent. solution makes the undissolved anilin insoluble, but is usually of little benefit, because the anilin dissolves quickly and has penetrated beyond reach of the tannic acid solution and accomplished its caustic action before treatment can be applied.

OPTIC NEURITIS AFTER INFLUENZA, WITH CHANGES IN THE SPINAL FLUID.[1]

By Dr. ARNOLD KNAPP, New York.

MRS. R., aged 32, came to the Herman Knapp Memorial Eye Hospital on December 7, 1914, stating that her sight had become affected two weeks ago, after an attack of grippe. She has always been in good health; married eight years; has had four children, aged 7, 5, 3, and 1; no miscarriages.

On examination.—Vision: R. = $\frac{15}{100}$; L. = $\frac{20}{100}$. There is a central scotôma for green. The optic nerves are somewhat swollen, with blurred outlines. There is a faint exudate on the temporal side, with a small hemorrhage in each eye. The right eye has a perfectly developed star figure in the macula. The left eye shows considerable œdema and haze in this region. The patient has no fever. Blood cultures are sterile; Wassermann negative; urine normal.

There is some discharge from the posterior ethmoid and sphenoid sinuses; cultures from the throat show the influenza bacillus and the pneumococcus. A lumbar puncture showed a cell count of twenty-one lymphocytes; globulin +; Wassermann negative; liquor sterile.

Dec. 9th, the right posterior ethmoid cells are opened up and an ethmoiditis is found present. The patient has no fever and does not complain of headache. The left fundus now shows a well-marked star figure in the macular region. Notwithstanding the nasal operation, the eye condition was not particularly changed. Pilocarpin sweats were then given for a number of days, without any effect on the optic neuritis. Gradually the right macular figure shows some retrogression, while the left one is becoming more complete. Vision $\frac{20}{100}$. There is no fever; patient complains somewhat of headache.

Dec. 14th, another lumbar puncture is made. The cell

[1] Reported at the Section on Ophthalmology, New York Academy of Medicine, December 20, 1915.

count is 14¼; globulin +. The nose is now perfectly clean; the opening of the ethmoid cells has had no influence upon the course of the eye trouble. A subcutaneous tuberculin test was followed by a marked arm reaction, some headache, temperature of 100.2°, but no local changes in the eye.

Dec. 21st, vision $\frac{20}{100}$; relative central color scotoma. Without any particular treatment, the fundus changes in the right eye have improved, the star figure is now only half complete. The left macular region shows a complete star figure.

Dec. 28th, slowly improving. Vision: R. = $\frac{20}{70}$; L. = $\frac{20}{60}$. The macular changes are being absorbed and the optic nerves are slowly returning to the normal.

Jan. 5, 1915. The condition has slowly improved. The macular changes are slowly disappearing, the blurring of the optic nerves is getting less, and the exudates are absorbing. Lumbar puncture shows a cell count of one lymphocyte and there is no globulin reaction. As a final test for syphilis, a luetin test is made, with negative result.

Jan. 18th, vision: R. = $\frac{20}{70}$; L. = $\frac{20}{40}$; central scotoma for green. Ophthalmoscopic changes are very much improved and are slowly disappearing. The nasal half of both macular figures has been absorbed. The outlines of the optic disks are normal; some of the blood-vessels show sclerotic changes.

Feb. 19th, vision: R. = $\frac{20}{40}$; L. = $\frac{20}{30}$. A few of the radiating lines of the star remain.

March 26th, vision: $\frac{20}{30}$ each. Small changes in the macular center.

Dec. 21st, $\frac{20}{30}$ each; slight retinal changes in maculæ.

The case is of interest because we have here a bilateral optic neuritis with that characteristic star-shaped figure around the macula which resembles the one found in albuminuric retinitis and at the same time differs from it, inasmuch as the figure is very much more delicate, more silvery. It resembles the star figure sometimes found in optic neuritis associated with brain disease and after influenza. The field defect was a central color scotoma. The optic neuritis ran the usual course, as is seen in influenza cases. There was a slow improvement uninfluenced by treatment, and after three months the ophthalmoscopic changes disappeared, the star figure in the macula going last; the vision now is not quite normal, $\frac{20}{30}$ each, as some minute changes remain in the macula.

The case is also instructive as bearing on the ways by which

optic neuritis is caused. It can be assumed that the optic nerves are affected through the blood, through the cerebrospinal fluid, or through the nasal accessory cavities.

Examination of the blood showed a negative Wassermann and the blood culture was sterile.

The cerebrospinal fluid was examined and showed very remarkable findings. The first lumbar puncture on Dec. 7th gave a sterile liquor and Wassermann negative, a cell count of twenty-one (lymphocytes), and a positive globulin reaction. The second puncture on Dec. 11th gave a cell count of 14¼ and globulin +. A puncture of Jan. 5th showed a cell count of 1 and no globulin reaction. These cerebrospinal changes were those of a mild infection, the expression of a toxic reaction on the part of the meninges to the influenza poison. The findings are like those occurring in late syphilitic infections; in our case a syphilitic infection could be definitely excluded.

It has always seemed possible in infections of the upper respiratory passages as occur in influenza that the optic nerves may suffer through the intermediary of the nasal accessory cavities. In this case, in fact, discharge was found coming from the posterior ethmoid cells, so that it seemed justified to open up these cells. After this was done, there was, however, absolutely no change in the ocular condition, so that this possible etiology can be excluded. The defect in sight, moreover, in optic neuritis after nasal sinus disease is different. In the latter condition the loss of vision is marked because of an absolute central scotoma which may be so large as to include the entire field, and a star figure in the macula has not been noted in the rhinogenic cases. The improvement after opening up of the ethmoid cells is usually prompt and decided.

In this case I think an infection from the nose and from the cerebrospinal fluid can be excluded. The optic neuritis was therefore caused by a hematogenous infection which at the same time produced a slight toxic reaction on the part of the cerebrospinal fluid.

TWO CASES OF METASTATIC OPHTHALMIA CONSECUTIVE TO PNEUMONIA.

By MARTIN COHEN, M.D.

BILATERAL metastatic panophthalmitis is rather a rare condition, its association with broncho-pneumonia and other infections is still rarer; therefore a report of this case is of interest.

The patient was a married woman 32 years of age, born in the United States. Her family history is unimportant, her past history presents the following occurrences which are significant:

At 15 years of age she had pleurisy. Three years ago tuberculosis was suspected. She has been married six years; no pregnancies. No evidence of venereal trouble. Wassermann blood test was negative. In early September, 1915, six weeks before the beginning of her present illness, a double salpingectomy was performed for chronic salpingitis; her recovery was prompt and without any after ill effects. Her present illness began on the 17th of November, 1915, with chilly sensations, fever and pains over the entire body; cough soon developed. Seven days after the onset of illness, Dr. Berliner first saw the case. Physical examination at that time by Dr. Berliner showed signs suggestive of a broncho-pneumonia. Respirations ranged between 32 and 40, and pulse 110; urine showed a large amount of albumen and casts. Six examinations of the sputum for tubercle bacilli were negative. From the onset of illness on November 17th to November 28th the temperature never rose above 99°. After November 28th, the temperature gradually rose until the 3d of December when it reached 103°, then rapidly defervesced. With the exception of high fever on one day subsequently, her temperature remained low until her death on the 14th of December. At the height of her fever on December 8th, a blood count showed 12,300 white

blood cells, 69% polymorphonuclears. Blood culture taken on the same day was sterile. Wassermann blood reaction was negative. Two days before her death she became restless, then unconscious. There was no loss of reflexes, no rigidity of neck, no Babinski or Kernig, no paralysis or convulsion, no apparent affection of the ears, ethmoids, or sphenoids.

Patient succumbed on December 14th, with œdema of the lungs; no autopsy was permitted.

Briefly then (excluding the eye condition) we have a patient who for four weeks showed the physical signs of a bronchopneumonia with negative sputum, and a nephritis.

On December 4, 1915, Dr. Berliner requested Dr. Cohen to make an ophthalmological examination. He stated that the present eye condition existed about twenty-four hours, and that it came on suddenly and simultaneously in both eyes and was associated with ocular pain and loss of vision.

The condition in both eyes being similar, a description will apply alike to each:

Examination revealed no light perception. Inflammatory œdema of the upper lid was evident. Mucoid conjunctival secretion was present. A moderate inflammatory exophthalmos was apparent. The eyeballs were not abnormally deviated. Mobility of the eyes was restricted. Marked chemosis of the bulbar conjunctiva was a distinctive feature. Intraocular tension was but slightly increased digitally.

The left cornea presented a small circular superficial ulcer. The right cornea was normal. The fluid in the right aqueous chamber was slightly cloudy, due to cellular exudation; the left contained, in addition, fibrinous masses. Pupils were equal in size but only moderately dilated, notwithstanding the previous instillation of a 1% solution of atropine sulphate. Iris markings were indistinct.

By deep focal illumination, a yellowish vitreous reflex was clearly seen in the right eye. Owing to the cloudiness of the aqueous it was impossible to obtain a light reflex from the left vitreous chamber.

These grave eye manifestations increased daily, and three days previous to the patient's death, a small hyphæma appeared in the left anterior chamber.

Half an hour after death, sterile record syringes were

inserted into the vitreous of both eyes; from the right a grayish fluid was withdrawn; from the left, the fluid was straw-colored. The vitreous fluid was transferred to serum agar culture tubes.

The bacteriological report by Dr. Noguchi is as follows:

In four blood agar culture tubes inoculated with the fluid obtained from the vitreous, there developed numerous colonies of streptococci in three of them, while one tube remained sterile.

In one of the positive tubes there were a few colonies of staphylococci, but the rest were pure streptococci.

The streptococci derived from this case assumed an appearance of diplococci, somewhat resembling pneumococci, but they were not agglutinated by anti-pneumococcus immune serums, which had been prepared in horses by injecting pneumococci, types I. and II., and which were strongly agglutinating for their corresponding organisms.

Since the above mentioned case-report was written the author, as so often happens, encountered a companion case, which must be regarded as an incipient panophthalmitis. The death of the patient before the picture of the latter could develop, constrains him to call it an endophthalmitis.

The patient was a married woman, aged 21, who was admitted to the Harlem Hospital, March 19, 1916. The family and personal histories were practically negative as far as the eye lesion was concerned. Some confusion was caused by the fact that the patient had been using slippery elm sticks for several months past to arrest gestation. Upon admission she was found to have a temperature of 103.4°, and was evidently acutely ill. There was dyspnœa, the respirations being 32, and considerable cyanosis of fingers and toes. The right eye was also involved and showed conjunctival injection with slight photophobia. There were also slightly diminished intraocular tension, sluggish pupil, and marked discoloration of the iris, the anterior chamber being filled with fibrinous exudate which prevented a study of the vitreous. There was slight chemosis of the bulbar conjunctivitis. Vision equaled light perception. Light projection, indefinite. The author's diagnosis was metastatic endophthalmitis.

An examination by Dr. T. H. Cherry on the day after admission showed that the uterus and adnexa were normal, so that

the attempts to terminate a supposed pregnancy had evidently been without permanent effects. The cervix was small and hard, the os was closed, and no discharge of any kind was present.

Physical diagnosis revealed a lobar pneumonia, right base. The sputum was not examined. The heart's action was feeble, sounds almost inaudible, pulse rapid, weak, running, artery not palpable. The urine contained numerous pus cells and but a faint trace of albumin, and was otherwise negative. The blood count showed 23,600 leucocytes with 90% polynuclears.

The patient lived but three days after admission. She complained principally of general body pains and cough and considerable pain in the eye. A smear from the latter showed no intracellular gram-negative diplococci. There was no response to stimulation, and on March 22d death occurred from pulmonary œdema. A well-marked hypopyon had formed in the anterior chamber of the right eye. All of the external manifestations of the eye had become more pronounced.

Autopsy was refused, but within five minutes after death 10*ccm* of turbid fluid had been withdrawn from the vitreous of the affected eye under sterile precautions.

The pathological report of Dr. Gonzales of the Harlem Hospital is in part as follows: A prolonged study of smears stained with gram and Smith's capsule stain showed but two kinds of organism each with the morphology of the pneumococcus.

Cultures on Loeffler's blood serum and blood agar showed after twenty-four hours in the incubator a moderately good growth of five cultures of less than 1*mm* in diameter which gave a positive gram. Culture smears showed mostly single diplococci, with slight tendency only to chain formation.

A positive agglutination test was obtained by centrifuging the supernatant fluid of an emulsion of cultures in normal saline solution after the addition of more solution and subsequent agitation of this emulsion. 3*cc* was then mixed in separate small test tubes with the same amount of antipneumococcus immune serum Nos. 1 and 2. After agitation and one hour of incubation there were evidences of agglutination in the tube

containing serum No. 2. A mouse was inoculated intraperitoneally with about 10*ccm* of the eye punctate. Next day it became ill and was found dead early on the fifth day. Culture specimen preparations obtained from the intraperitoneal exudate have not yet been fully examined. The presence of the pneumococcus, type II., was recognized in smears.

Remarks. Upon consulting a number of current reference works we find that as a rule internists make no allusion to intraocular complications as such. After mentioning the more constant and characteristic complications(meningitis, arthritis, etc.), some of these writers sum up the minor manifestations of this kind with the brief statement that they differ in no wise from typical inflammations of the organs in question. No hard and fast line can be drawn between panophthalmitis and endophthalmitis. The latter may represent the initial stage of the former in cases where pneumonia ends fatally at an early period. On the other hand authors mention an essentially benign type of intraocular infection which is naturally limited to an iridocyclitis without pus formation. As far as the author has investigated the subject, he finds that his only predecessor in the literature of the Western Hemisphere in reporting metastatic panophthalmitis following lung infections is the late Chas. Stedman Bull.

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ON THE CORRECT USE OF THE GIANT MAGNET IN OPERATIONS ON THE EYE.

By Prof. O. HAAB, Zürich.

Translated from the *Arch. f. Augenheilk.*, Vol. LXXVII., No. 4, 1914.

IT is now twenty-two years ago that after a few successful cases I came to the idea of drawing iron particles out of the depth of the eye with a strong magnet. In the first case there was a moderately large splinter which had penetrated the eye and remained in the deepest layers of the lens, projecting somewhat into the vitreous humor. It seemed probable that the foreign particle would become lost in the vitreous, so that its early removal seemed indicated. As the small magnet was of no avail, it seemed worth while to me to try a large magnet and to observe whether by distant action the splinter could be drawn from the lens. The success of the attempt seemed very problematic to me, as the lens in a woman of thirty-two has considerable consistency.

When the eye was approached to the large electro-magnet in our physical laboratory and the current was closed, the splinter immediately passed through the lens into the anterior chamber and was then easily removed with the aid of a small incision. This extraction of a foreign body at some distance led me to try a similar maneuver a few days later in a case where a foreign body was situated in the posterior part of the vitreous. In this case the splinter promptly was drawn into the anterior chamber and successfully removed.

Thus was the method of a traction of distant objects conceived, notwithstanding Knies's view of its impracticability. This author, as well as McHardy and Hill Griffith, had used a large magnet in a few cases of foreign bodies in the anterior

part of the eye, but these attempts were given up as they did not succeed, probably because the cases were not suitable and the magnets not strong enough. These three authors did not believe that a powerful magnet could attract a forcign particle from so great a distance. At first it was not clear by what path a foreign particle travels when it is extracted from the deeper parts of the vitreous. In the last case just mentioned it seems to me that the particle passed through the lens into the anterior chamber following the original path of entrance. Experiments on animals' eyes, however, in a very short time convinced me that a foreign particle situated in the vitreous can easily be attracted and drawn forward, passing around the lens into the anterior chamber. The particle appears so rapidly in the anterior chamber that it would seem that it passes through the iris. This, in my experience, however, is very unusual and only is possible in the ciliary portion of the iris when the pupil is made tense. Under certain conditions the particle may pass through the original opening that it made in the iris in entering the eye. In most cases, however, the particle enters the anterior chamber through the pupil, particularly if it is possible to have the pupil dilated. Frequently on the closure of the current a foreign particle situated in the vitreous will immediately present on the posterior surface of the cornea.

After presenting the results of my first operations for the extraction of particles from the interior of the eye, at the meeting of the Heidelberg Society, I did not proceed to the construction of a special large magnet, but continued to use the electro-magnet in our physical institute. In the meanwhile Schlosser, after hearing of my results, had a magnet made which seemed to me to be too small, because I had already become convinced that for our purposes the magnet must be as strong as possible. Several years ago I had constructed a more powerful instrument which was at the time the strongest magnet and possessed some other important improvements.[1]

[1] I did not consider it decent to patent my magnets, because the instrument serves humanity. This was perhaps a mistake, as a number of unsatisfactory magnets have been constructed and advertised under the name of "Giant Magnet," or "Haab's Magnet." Many of these were made too small and they did not possess a feature which I consider of great impor-

About three hundred operations were performed at our clinic with my first magnet. I should like to report briefly upon my results and the rules which should guide us in this operation.

In order to properly take advantage of the magnet operation it is necessary to understand clearly some fundamental facts. First, there is a fundamental difference in the action of the small and the giant magnets. The small magnet which was devised by McKeown and modified and strengthened according to the suggestions of Hirschberg, Frohlich, Snell, Wagenmann, and others, was primarily the most suited instrument for grasping an iron particle situated in the interior part of the eye. It is well known that it is difficult to grasp a small particle with a forceps, without causing a good deal of damage to the tissues. And before the introduction of the small magnet, most eyes which had suffered injury from the penetration of a foreign body were as soon as possible enucleated. The small magnet as originally constructed grasped the particle as soon as it came in close or in actual contact with it. It was an excellent instrument to grasp the foreign particle, vastly superior to the forceps. Later, when we understood the distant action of a large magnet, the small magnets were enlarged and developed a certain distant action which permitted them to attract a foreign particle at the distance of several *mm*, especially when situated in the vitreous.

The large magnet, on the other hand, attracts in proportion to its size. It acts like the magnetic mountain in the story which extracted the nails from the approaching vessel so that it sank into the sea. In order to make proper use of this distant action, we must understand the lines of force which the giant magnet exerts. These lines of force diverge from the tip of the magnetic pole with considerable divergence or diffusion. The "Innenpol" magnet of Mellinger has a less divergent effect upon these lines of force. These lines remain very much nearer together, and therefore a greater number of lines of force approach the foreign body and attract it more forcibly than when these lines are more diffuse. The advantage of this is that the power of attraction is increased; the

tance, namely, that the operator himself is able to close the current by means of his foot.

disadvantage that the magnet seeks the foreign body in the eye in a less rational way. If we consider the way in which the magnetic lines diverge from the magnetic pole when it is situated at the middle of the cornea, we know that the foreign body is drawn forward in the most advantageous manner in a direction towards the middle of the lens. When the foreign body has reached the posterior surface of the lens, it passes, following the line of least resistance, along the smooth surface of the lens capsule to the lens equator and comes in contact with the posterior surface of the iris, as the zonular fibers do not offer much resistance.

The most important point of the operation consists in the prevention of the impaction of the foreign body into the posterior surface of the iris. If this takes place, the completion of the operation is made more difficult. Otherwise the extraction is readily completed. The patient is asked to look to the side and the foreign body is promptly drawn through the pupil into the anterior chamber.

Fortunately the foreign particle generally has a shape which facilitates its sliding around the lens and its passage through the pupil. These particles in most cases have an elongated rounded form, like a cucumber seed. The broad side in the middle or a little to one side of the middle represents the edge of the hammer or of the chisel. The back side is the site of separation, which is usually shiny, somewhat wavy. The edges as well as the two extremities may be more or less sharp.

This is the typical form obtained from the study of two hundred splinters. There are many variations, with projections, with extremely sharp extremities, with so-called roughened edges, etc. The passage of these is naturally not so easy and they have the particular tendency of burrowing into the iris tissue.

This penetration of the posterior surface of the iris can be controlled by: (1) Dilating the pupil at maximum before the operation, and (2) by immediately opening the contact when the particle arrives behind the iris. This is an extremely important moment in the success of the operation. Before all things the head of the patient should not be fixed and the head can then be drawn away reflexly by the patient as soon

as he experiences pain from the splinter touching the iris. Consequently I am not in favor of having the patient lying down during the operation, and it is not advisable that the head should be steadied by a chin-rest. It is best that the head of the patient be held by the hands of the operator who is standing either to one side or behind the patient. The opening of the contact and the shutting off of the current should be performed by the operator himself and by means of his foot. This is more advantageous than when the opening and shutting of the current is relegated to an assistant.

To correctly judge of this important moment when the particle comes in contact with the iris, it is necessary to have the operative field well illuminated. The magnet therefore must not be too broad and the pole must be projected sufficiently from the winding. The light can be furnished by any form of lamp which is then concentrated by a large convex lens, or a Nernst lamp with lens can also be used. As soon as the iris shows the slightest bulging, the current must be interrupted. When the splinter has reached the posterior surface of the iris without becoming entangled, it then must be attracted through the pupil into the anterior chamber.

This can be accomplished by giving the eye the correct position. In other words, the eye must be turned to one side, namely, to the side where the splinter is situated behind the iris. For attracting the splinter in this position, as the force does not need to be so great, a longer tip can be applied to the magnet. It is well known that the longer the tip the weaker the magnetic power.

If the particle has become wedged or will not enter the anterior chamber, it must be attracted in various directions with considerable patience and great care that it is not drawn into the ciliary body. If these maneuvers remain unsuccessful, we can either: (1) Make an incision in the cornea and introduce the hand magnet behind the iris, which is easily possible without danger to the intact lens, or we can use Lang's cable, which consists of a thin bundle of soft iron wires with a suitable tip which can be attached to the large magnet and acts like the hand magnet. (2) If the splinter remains adherent to the ciliary portion of the iris and it cannot be dislodged, an iridodialysis can be made; after an incision at the margin of

the cornea, an iris forceps is introduced, the iris is seized and drawn toward the pupil. This procedure is less injurious than the iridectomy. The long tip of the large magnet or the cable is then introduced into the anterior chamber and the splinter extracted. I have had recourse to this procedure in very small particles, which, as is well known, are the most difficult to extract.

Iridectomy should be omitted as much as possible in the magnet operation. I have never been forced to perform it in about three hundred operations, and I believe the bad results which Stedman Bull (*Trans. of the American Ophth. Soc.*, 1910) reports are due to the iridectomy which was performed in so many cases. On the other hand iridodialysis should not be made the rule or particularly recommended as Weeks does in his text-book. This intervention is surely not without danger for the iris and ciliary body and may cause a large hemorrhage.

In the usual cases the particle is drawn through the pupil into the anterior chamber and to the posterior surface of the cornea. On opening the current it sinks into the lower angle, when it can be directly extracted with the large magnet, or the patient can be placed on the operation table and the hand magnet employed. If there is a recent wound of the cornea and its situation is favorable, this should of course be made use of, though it may require considerable patience and at the same time often succeeds in wounds which are even from two to three days old. If this does not succeed, it is well to make a vertical wound with a cataract knife between the corneal margin and the corneal center, about twice as long as the diameter of the particle. This incision can be made without allowing the aqueous to escape. It is necessary, in order to extract the particle easily out of the anterior chamber, that the aqueous be present. I usually make the incision with the patient sitting down and then immediately use the large magnet. I consider it a mistake to open the anterior chamber in the periphery, as this easily leads to prolapse of the iris, adhesion of the iris, and with a peripheric wound the extraction is often made more difficult.

If on applying the magnet the foreign body apparently is not attracted, though the current is closed and repeatedly

opened, it can be assumed that the foreign body is situated quite posteriorly in the eyeball where it may be firmly attached, arrested in exudate or hemorrhage. I then attempt to bring the magnet somewhat nearer to the probable site by approaching the eye to the magnet at various points of its equator, and then again apply the current interruptedly. It is a great help to know the probable location of the foreign particle. Sufficient information on this point can usually be obtained without the use of the sideroscope or the X-ray in many cases, if we carefully examine by oblique illumination the point of entrance and study the direction of the canal, then testing the projection.

In my study of the first 165 cases, in about half of the cases the lens was not injured. This condition, of course, facilitates the exact localization of the foreign body. It is often necessary to continue the attempts to attract the foreign particle for some time. Observation of the ophthalmoscope has shown that the splinter will only slowly follow the magnetic attraction and only gradually emerge from the exudate, hemorrhage, or the retina. If the splinter has been freed and attracted to the equator, sensation of pain on the patient's part is usually elicited. The current then must be instantly interrupted so that there is no chance of the splinter penetrating the region of the equator, and the pole of the magnet must again be applied to the center of the cornea. In no case should the point of the magnet be drawn along the surface of the sclera over the ciliary body. The ciliary body would otherwise be unnecessarily injured and frequently a foreign particle, if caught in the ciliary body, can again not be dislodged. Particles which primarily penetrate the ciliary body are very difficult to remove.

If the repeated opening and closing of the current still fail to attract the foreign body, I proceed to the examination with the X-ray and with the sideroscope. It seems to me that these methods are absolutely superfluous if performed previously, and in fact injurious on account of the necessary loss of time, thereby favoring the progress of a possible infection in most cases. The large magnet approximately in half of the cases immediately draws the foreign body behind the iris, which of course confirms the diagnosis. Why, then,

should it be necessary to wait for the result of the examination with the sideroscope and the X-ray? Experience has, however, shown that the smaller the splinter the less does it follow the magnetic force, and conversely, the larger it is, the more easily is it attracted. A large splinter is therefore apt to shoot forward with considerable force and may injure the lens if the structure is not already injured. In half of my carefully examined 165 cases the lens was injured by the penetration of the foreign body, and consequently further injury in the extraction does not count. In order to extract a large splinter carefully, it is necessary to attract it slowly. This can be accomplished by reducing the force of the magnet by letting it act at a greater distance from the eye and with the use of the long tip. This is better than the interpolation of the rheostat.

Theory and practice do not quite agree in this point. Clinical experience promptly taught me that small particles are attracted with much greater difficulty than large ones. This can be easily confirmed experimentally with pigs' eyes. The attraction of a foreign body through the vitreous, which is tissue and not fluid, can be decidedly retarded. This, of course, is an advantage in the extraction of large or middle-sized particles. The distance between the splinter and the magnetic pole naturally influences the power of the attracting force. In a large splinter as it approaches the magnet the distance must be rapidly increased or a longer point used.

The action of the flat pole of the Volkmann magnet, which is the most powerful attracting force, I have been able to equal in my magnet by simply unscrewing the tip. It is therefore natural that small splinters should be attracted as forcibly as possible. In large splinters the force should be diminished by using the long tip or by keeping the eye at a greater distance from the magnet.

Information about the size of the splinter can be furnished by the sideroscope where the amount of excursion of the index indicates the size of the splinter. The X-ray also gives us information on this point. On the other hand, we can get approximate information which is of value by careful examination of the eye by oblique illumination, with the ophthalmoscope and testing of the projection. Generally large

splinters cause a large wound in the cornea or sclera, and the wound in the iris and lens caused by large splinters is also a large one. Exceptionally, a long narrow splinter may enter through a comparatively small wound.

This kind of foreign body follows the magnetic attraction in its longest diameter and consequently causes less damage than an angular, broad, irregularly formed splinter. The larger the splinter is, the more carefully and slowly must it be attracted.

In a consideration of the large particles another question arises. Should a large splinter be drawn through the pupil into the anterior chamber? If the lens has already been injured, the foreign particle can be drawn through the same path. If it has left the lens free and has penetrated a depth along the side of the lens, it can then be extracted laterally through an incision in the sclera, though this I consider a very much more difficult procedure and one which is apt to be followed by retinal detachment. I have practically never performed this extraction through the sclera. In all of these large splinter injuries the prognosis is dubious and probably the eye has already suffered a great deal of damage, so that it may be justified to extract laterally.

It goes without saying that it is necessary when extracting a large splinter laterally through the sclera that the operation be performed slowly and with care. It is quite sufficient if this method is to be adopted to proceed according to the old method and use the small but powerful hand magnet. As to the dosage of the attracting power, it is well to remember that in particles which have recently entered into the eye the attraction need not be as powerful as in old cases where the particle has become fixed in the tissue. In the latter case the most powerful attractive force is necessary to dislodge the foreign body.

What is our procedure if the small or middle-sized splinter enters the eye through the sclera, the cornea remains intact, and the case is a recent one? Is it then best to extract the foreign body laterally through the point of entrance? In my opinion this question must be answered by the determination of which zone of the sclera has been penetrated by the foreign body. If the foreign body passes through the zone of

the ciliary body I should under no circumstances endeavor to extract it through the original point of entrance, because the foreign body would find it difficult to leave at this point unless the tip of the magnet were introduced into the vitreous, which is surely dangerous and difficult if the opening is small. My primary rule is to leave the ciliary body alone as much as possible. In such a case when the splinter is small or medium sized, I would endeavor to draw it through the anterior chamber; if it is a large splinter which might injure the lens, I would incise the sclera at a considerable distance from the ciliary body and then extract it from this opening. If one draws a particle through the ciliary body along the path of entrance, with great probability cyclitis will develop. If, on the other hand, the foreign body is extracted through a suitable opening at the equator, a detachment of the retina may develop, but that is not quite so serious. In general I consider an incision through the sclera, choroid, or retina as unsatisfactory, and only permitted if there is no other way open.

The rule in magnet operations should be the careful attraction forward into the anterior chamber. The method of operating through the sclera should be the exception. If we examine the size and the form of the splinter, we find the following results: From 300 magnet operations I have formed a collection of 243 iron particles. A number were lost in experiments on animal eyes or in demonstrations. A few have rusted away. Some have been removed from eyes which were enucleated later on. I have carefully weighed every splinter and measured its length and breadth. The weight of 90% of these 243 was small or medium. That of 10% was so great that their extraction through the sclera might be considered. The weight in the 90% varied from 0.1*mg* to 0.1*cg*. The remainder were more than 0.01*grm*. The largest group, namely 40%, weighed 0.001 to 0.005, and 57% represents the splinters weighing from 0.001 to 0.01, a weight which is particularly suited for my method. The small and the smallest splinters, those weighing less than 0.001, can best be extracted forward, but they require a very strong magnet.

A study of form and weight of the splinters shows that my

method of extraction by way of the anterior chamber is the most suitable.

CRITICISM OF OTHER PROCEDURES IN THE MAGNET OPERATION.

Let us first of all again consider the extraction of foreign bodies laterally through the sclera instead of through the anterior chamber, as the method which makes the strongest opposition to mine. As previously stated, I do not consider this procedure as correct. It is, in fact, the old magnet operation with its great disadvantage of subjecting the eye to greater injury through: (1) an incision going into the vitreous; (2) the introduction into the eye of the tip of the magnet. The point of the magnet does not need to be introduced as deeply as in the case of the little magnet. The incision, however, suffices to cause an adhesion of the vitreous at this place and is apt to be followed by changes which lead sometimes after years to a detachment of the retina. I should like at this point to draw your attention to my previous paper on this subject.[1]

In this method of lateral extraction the distance action of the large magnet is not properly made use of. In other words, we remain at the lowest step in the old magnet operation as it was formerly practiced with the small magnet, a method which should be as much as possible curtailed. The supporters of this method justify it by the statement that the foreign body is extracted along the shortest possible way. If it is extracted by the longer way, anteriorly, there is more danger of additional tissue injury and of infection.

I do not think my experience can support this contention. If a foreign body on extraction can disseminate infectious germs, the eye is in a very serious condition under all circumstances, and the danger of infection will be just as great if the lateral method be adopted instead of the anterior one. Many splinters are aseptic, consequently the mechanical injury of the tissues need only be considered. This is unquestionably greater in the lateral extraction, and we must remember in this latter case that there is a possibility of

[1] Haab, "On a New Model of my Large Eye Magnet, and the Method of Employment of these Instruments." ARCH. OF OPHTH., p. 476, vol. xl., 1911.

adding a fresh infection to the vitreous from the conjunctiva. We know that the conjunctival sac is rarely sterile and the time is often too short to properly treat the conjunctiva before operation is undertaken. If the extraction is to be made laterally, an exact localization of the foreign body is necessary with the sideroscope and the X-ray. This is particularly important when the small magnet is used, because it is necessary to bring this magnet as near as possible to the foreign particle. This time-destroying examination is an additional objection to the lateral extraction.

I also consider that it is not wise to lose time in every case for an exact localization of the splinter. I think it is necessary that the foreign body should be localized only when the large magnet does not succeed in drawing a splinter forward or does not cause a painful sensation. It is perfectly immaterial in using the giant magnet according to my method where the foreign body is situated in the eye. The conditions when using the internal pole magnet of Mellinger are somewhat different, as in this case the dispersion of the lines of attraction is restricted. Consequently, the attraction is more along a straight line. This is probably not as convenient for the primary search for the foreign body. I confess that my experience, however, on this point is lacking. Theoretically I should say that the dispersion of the lines of force is more favorable particularly for the particles which are situated near the ciliary body or directly posterior, especially for those in which extreme care must be taken that they are not drawn into the ciliary body.

Those who work with an insufficiently powerful magnet require a previous localization of the splinter, because the magnetic pole must be approached nearer to the foreign body than when the magnet is strong. I am gradually coming to the conclusion that the praise which is accorded the primary localization of the foreign body is the result of the use of insufficiently powerful magnets.

Be that as it may, it is a matter of great importance whether the foreign body is removed within a half hour or within a half day. It is natural that the longer the splinter remains within the eye the greater is the degree of infection. I have become convinced that the splinters resulting from hoeing, which are

usually so infectious and consequently so dangerous, cause less infection if they are rapidly extracted than if they remain in the eye for a long time. The splinter should, furthermore, be extracted as rapidly as possible because it is well known that a foreign body situated in the vitreous, particularly in its posterior parts, may cause permanent damage to the macula lutea, though it be situated at a considerable distance from it. I drew attention to this form of macular disease in the transactions of the Heidelberg Congress in 1888, and a number of pictures illustrative of this condition are to be found in my atlas.

The popularity of the small magnets is diminishing; nevertheless authors still write that the large or the small magnet can be employed, and the impression is current that in certain clinics these instruments are used alternately. I consider this wrong. The field for the small magnet is a very limited one. In general the operation should be carried on with the large magnet. The small magnet is principally, as it always has been, the best instrument to grasp the magnetic splinter, and even in the case of the new large hand magnet, the distant action is a small one, and it is exactly this distant action which makes the operation of extraction less injurious to the tissues. I, myself, use the little magnet only very occasionally. It can be used in the extraction of the foreign body from the anterior chamber, though this can be just as well done with the large magnet, especially with the addition of Lang's cable.

I have already stated my reasons for not favoring operations with the patient lying down, which is frequently recommended and practiced. I cannot understand why certain operators prefer to operate with the patients lying down. There is really no good reason for this, especially if my method is to be followed, and we lose that important feature, namely, the rapid withdrawal of the head of the patient, as has been already described.

It seems to me that the large magnet has been suspended over the patient to satisfy those who have become accustomed to handle the small magnet. Those that operate on the patient lying down with the suspended magnet, under certain conditions make the operation more difficult for themselves and vitiate their results.

The new model of my magnet is constructed by the Oerlikon Engine Works near Zürich. Questions concerning the instrument should be directed to the factory. The lines of force can be shown by attaching a board with one side cut out to embrace the magnet. Then iron particles are scattered regularly over this surface. The current of the magnet is then closed and on slightly shaking the board the iron particles group themselves according to the lines of force. If we compare the power of the new model with the steel bell with that of the magnet without the bell we find that a magnet of this size is capable of developing an attractive power of 500 times the weight of the foreign body to be attracted. It has been found that the cast steel bell increases the magnetic power. The experiments were carried on up to a weight 515 times that of the steel body weighing 2.03*gr.* In the last experiment the magnet without the bell was able to attract a weight 515 times greater at a distance of 2.8*mm*, while the same weight was attracted in conjunction with the cast steel bell at a distance of 4.2*mm*.

Finally, it need not be emphasized that these powerful magnets will injure a watch if it is brought within the magnetic field, that is, within half a meter, in a very brief length of time.

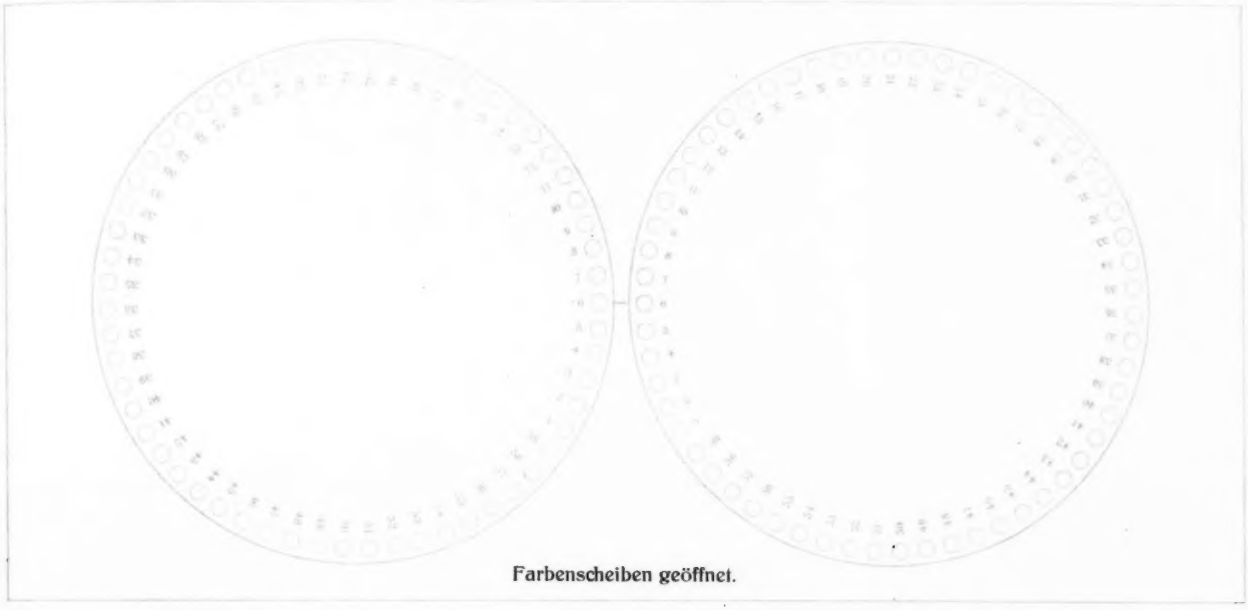
ON THE EXAMINATION OF THE COLOR SENSE WITH PIGMENT COLORS.

By Dr. HELMBOLD, Danzig.

Translated from *Archiv f. Augenheilkunde*, Vol. LXXV., 1913.

(With Appended Plate XXIII., from the German Edition.)

THE obligatory examination for color sense with Nagel's plates by the railroads, army, and marine has fostered energetic controversy over the relative values of the different methods of examination. The competitors of the Nagel's plates are the pseudo-isochromatic tables of Stilling and the cotton wools of Holmgren. The latter have occupied for years the dominating position and are still regarded at the present day by many as being the most practical and reliable. The Holmgren test gives us excellent results and, at the hands of an experienced examiner, serviceable means for examination, though it is not at all unusual for it to fail. This has been proven unquestionably by a number of investigations. I, myself, have observed a number of cases in this sense. This is easily explained if we remember Nagel's statement, that the individuals must recognize colored objects both on land and on sea at a much greater distance—in other words, with a much smaller visual angle, so that we must examine the function not of the more peripheric parts of the retina, but particularly the fovea centralis. This is carried out in the examination with Holmgren's wools on account of their size. Furthermore, it is impossible to determine with these the increased color contrast which is characteristic for the anomalous trichromates, and consequently an erroneous diagnosis can not be avoided. If those that favor the Holmgren method would



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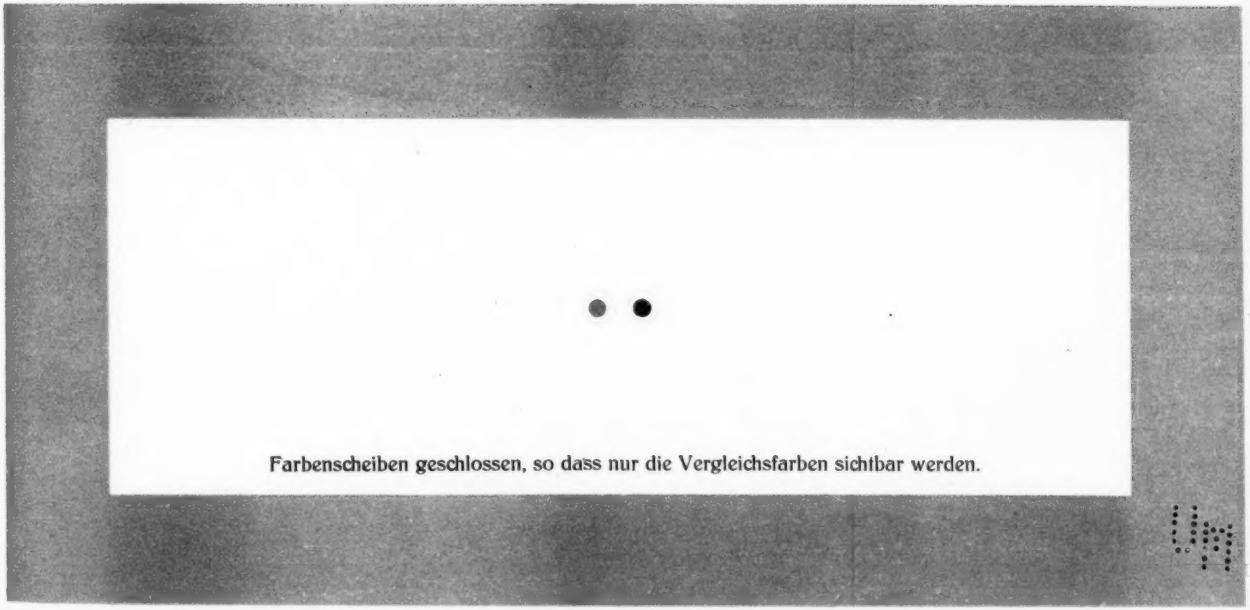

Farbenscheiben geschlossen, so dass nur die Vergleichsfarben sichtbar werden.

Helmbold, Beitrag zur Prüfung des Farbensinnes mit Pigmentfarben.

Verlag von J.F. Bergmann, Wiesbaden.

only recognize this fact and convince themselves of its correctness by the use of Rayleigh's equations, the mercantile marine would then probably give up its unfortunate standpoint.

In recent years Stilling's tables have again been generally accepted, especially since the colors have been produced without gloss in recent editions, and the number of changing colors has been increased. Recognizing their great diagnostic use, I do not believe that they should be used as the exclusive method of examination. With Stilling's test it is not possible to determine color defects with certainty. At the same time, the increased color contrast can also not be determined. There are a number of cases now on record in which the Stilling plates were read without hesitation, and notwithstanding dichromasia or anomalous trichromasia was present. Not long ago I was able to confirm this observation in the case of a railroad official. This individual was able to pass the Stilling test, but on examining with Nagel's plates there was a distinct error in color perception, and at the anomaloscope he proved to be deuteranomalous. Furthermore, there are persons who can decipher certain of the Stilling plates (Table IX.) only with the greatest difficulty and are nevertheless color-sound.

Nagel's plates are objected to by some because their use demands too much of the intelligence of the person examined, and because it frequently leads to erroneous diagnosis, in which a color defect is overlooked or where the diagnosis of color blindness is made in cases where the anomaloscope shows color soundness. The procedure requires sometimes a great deal of patience, though I have been able to carry out the examination even in less intelligent individuals. If an erroneous diagnosis of color blindness is made, the second examination with the anomaloscope will quickly detect the error. These erroneous diagnoses can be reduced to the minimum if the examiner follows carefully the rules laid down by Nagel. I have generally obtained excellent results with this method of examination. Exceptionally it has not been possible to discover anomalous trichromates with Nagel's plates. Similar experiences have been shared by others.

I, personally, prefer the Nagel test, as being more reliable.

It, as well as the Stilling test, however, occasionally fails. Either method is improved if we use both methods; as it practically never occurs that an erroneous result is obtained both by Nagel and with Stilling.

Numerous investigations have shown that there are all grades between complete color blindness and complete color sense. It is possible to produce all combinations of colors with a spectral color-mixing apparatus, and to change their hue and their intensity at will. The use of pigment colors for these purposes has its limits, and that is the objection to the various methods by which pigment colors are employed. This could be improved by increasing the number of changing pigment colors.

I have endeavored to devise an apparatus which will enable the general physician to recognize all deviations from normal color perception.

The apparatus consists of two revolving disks of 18*cm* diameter, which carry, concentric to the margin, at about 3*mm* distance, small colored circular disks of 6*mm* diameter, with an intervening space of 3*mm*. These plates show 58 changing colors. In the selection of these I have used the ones which I have found of service, as well as the colors suggested by Stilling, Nagel, Holmgren, and Daai. The disks are about 4*mm* apart, and by rotating one upon the other it is possible to compare the color of one disk with that of the row below. There are two openings in the higher disk, which covers all other colors except the two which are to be compared. Next to the colors there are small numbers which will enable the exact notation of the color equation.

These color disks are very easily used. The one to be examined, standing with his back to the window, regards at a distance of one meter, in good daylight, the selected color on one disk, while the examiner slowly rotates the second disk, so that its colors slowly present through the small opening and can be compared with the selected color on the first disk. The rotating of the disk can be arrested at any moment by slight pressure by the finger.

According to Nagel, the red-green blind confuses:

1. Bright red with: dark yellow, brown, olive brown, green-yellow, olive green, dark orange.

2. Orange with: fire-red, brick-red, yellow-green, yellow.
3. Yellow with: bright red, bright orange, yellow-green.
4. Yellow-green with: bright red, brick-red, orange, yellow.
5. Green with: gray-yellow, gray-brown, gray-pink.
6. Blue-green with: gray, white, pink.
7. Pink carmine red with: gray, blue-green, brown-green.
8. Green-blue with: sea-blue, white-blue, pale violet.
9. Blue and violet look alike.
10. Red-violet with: pale violet, pale blue.

We begin with a red, without naming or asking the patient to name the color. We then ask him to select from the second disk several colors which are similar to the one selected, the doctor rotating the disk. A similar procedure is followed through green, gray, etc. If any of the above-mentioned confusing colors are described as being the same, the individual is supposed to be weak in color perception. This method does not permit the determination of the exact form of defect (dichromasia or anomalous trichromasia).

It is possible to determine if increased color contrast is present, by comparing a gray brown or a yellow with the red. These appear to the one with defective color perception as green, while if they are selected next to green, they appear to him red. As the color defective requires a good deal of time to recognize the same colors, it is possible to use two colors, and by removing the covering disk they will be made visible for a very short time and the anomaly of color sense determined. Those with normal color vision have no difficulty in passing the test.

Finally there are also confusing colors for the determination of blue-yellow blindness. These individuals confuse:

1. Blue-green with blue.
2. Green-yellow with gray or violet-pink.
3. Yellow-green with blue-violet.
4. Yellow-red (orange) with purple.

This procedure does not include the naming of colors. It can be carried out systematically and furnishes, when properly conducted, as certain results as can be obtained by the various

methods of examination with pigment colors. Additional investigations will show whether this satisfies all demands, or whether the number of confusing colors should be increased.

The rotating color disks are obtainable in a cover from J. F. Bergmann, Wiesbaden.

DESCRIPTION OF AN EXOPHTHALMOMETER.

By Prof. W. LOHMANN, Munich.

Translated from the *Archiv f. Augenheilkunde*, Vol. LXXV., 1913.

(*With two illustrations in the text.*)

THIS exophthalmometer is reasonable in price and sufficiently exact in its results, and satisfies the two following conditions: First, the apparatus should not annoy the

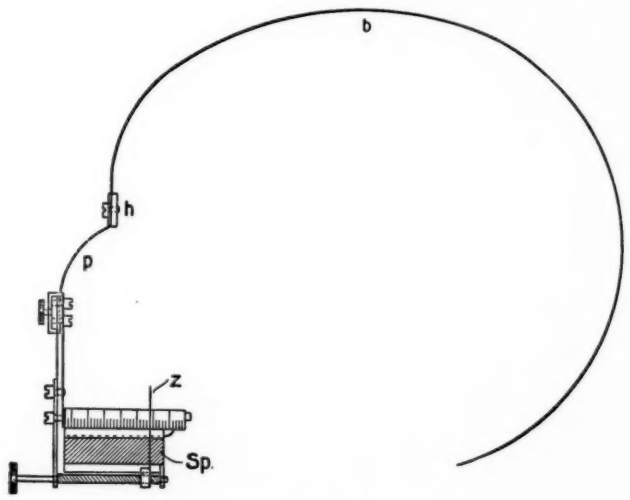

Fig. 1

patient, and permit a correct reading in every position of the head. Second, the unpleasant attachment and fastening of the apparatus by the physician is avoided during the examination.

Furthermore, it is excellently adapted for purposes of demonstration in clinics. It is being made by Dörffel & Färber, Berlin, Chaussée str. 10.

The apparatus is held fast by means of a springlike bow which is attached to the sagittal plane of the head (Fig. 1, b). This carries a horizontal contrivance in which are fastened two rods laterally movable and supporting at their extremities a counting measure (Fig. 2, st). The latter has a point of support (Fig. 2, a) which is to be applied to the outer orbital

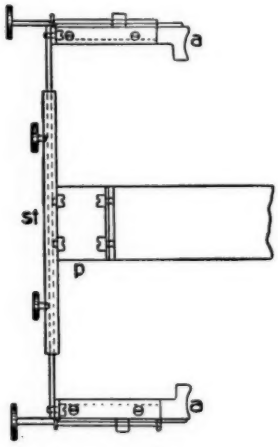

FIG. 2

margin, a millimeter scale, and a measuring appliance which is controlled by a screw (Fig. 1, z). The proper alignment is made by means of a mirror which is attached 6*mm* behind the measuring appliance and below the millimeter scale (sp, Fig. 1).

The apparatus is applied to the head by opening the bow and placing its free end on the posterior occipital protuberance. The anterior extremity (h, Fig. 1) comes to be placed on the forehead, a little above the frontal glabella. The two movable rods (st, Fig. 2), are pushed forward enough to permit the placing of the orbital attachment (a, Fig. 2) exactly over the middle of the external orbital margin. The measuring apparatus is lightly applied against the orbital margin by

means of the middle spring (p, Fig. 1), which can be more or less bent. There are two bands which steady the apparatus. These are fastened around the head below the occiput. The reading is done by observing with one eye when the measuring apparatus coincides with the image in the mirror. Then, by means of the screw, the measuring point is advanced until it forms a tangent to the corneal part. This degree is then permanently marked on the millimeter scale.

REPORT OF THE PROCEEDINGS OF THE SECTION ON OPHTHALMOLOGY OF THE NEW YORK ACADEMY OF MEDICINE.

By GEORGE H. BELL, M.D., Secretary.

MONDAY EVENING, DECEMBER 20, 1915. H. H. TYSON, M.D., CHAIRMAN.

Dr. W. B. Marple showed a case of **pneumococcal ulcer of the cornea treated with serum and vaccine.** The patient, L. G., aged twenty-six, was admitted to the Infirmary on Nov. 10th, stating that on Oct. 28th he had been struck in the left eye by a piece of marble on which he was working as a stonecutter. On admission, there was a central ulcer of the left cornea about 3*mm* long. Bacteriological examination showed that the infection was due to the pneumococcus. Two days later the ulcer had increased considerably in size, and was cauterized with the actual cautery. Three days after this the ulcer was slowly spreading, and it was treated with pure carbolic acid. On Nov. 17th the ulcer measured 5 by 7*mm*. There was a hypopyon 4*mm* high, and it was evident that the ulcer was rapidly progressing in all directions. On that day the patient was given a stock pneumococcus vaccine subcutaneously, 2,000,000, and the pneumococcus serum (both procured from the New York Board of Health) was instilled every hour. Forty-eight hours afterward, he was given another dose of the pneumococcus vaccine, and five minims of the pneumococcus serum were injected subconjunctivally. This treatment was continued—that is, every other day the vaccine and ten minims of the serum subconjunctivally. Forty-eight hours after this treatment was begun the hypopyon had entirely disappeared, and there was no further evidence of increase in

the ulcer. Repair took place uninterruptedly until Dec. 8th, when the patient was discharged with the ulcer healed.

Dr. H. W. WOOTTON presented a patient with **chorioretinitis.** Female, twenty-four years of age, unmarried. She stated that her right eye had been practically blind since her fifth year, but that she had seen fairly with the left eye until about six months ago, since which time the vision had progressively deteriorated. Had "water on the brain" in infancy, and, later, measles. No other diseases of childhood. Father and mother were cousins. No eye trouble in three brothers and sisters. Three or four brothers and sisters had died when about one week old. Wassermann, strongly positive. V. O. D. doubtful p. l. ; O. S., fingers at four feet. Field O. S., marked contraction. Fundi: Disks very pale, marked vascular degeneration resembling that seen in last stages of retinitis pigmentosa. Scattered throughout retina, but most marked at posterior pole, were numerous white spots about the diameter of a large retinal blood-vessel; also several larger black masses of pigment scattered irregularly. The optic atrophy and vascular degeneration were undoubtedly secondary to the degenerative changes in the retina. The case might be regarded as an hereditary specific chorioretinitis of an unusual type, or as an imperfect example of retinitis punctata albescens. Many of the reported cases of the latter disease do not coincide very closely with the description of Mooren and Fuchs.

DISCUSSION: Dr. J. E. WEEKS thought it was a case of atrophy of choroid and retina following specific disease, like atypical retinitis pigmentosa.

Dr. BRUDER showed a case for Dr. R. G. REESE—**a piece of copper removed from the vitreous chamber.** The patient, a man forty years of age, while at work was struck by a piece of copper from an explosion. Dr. Reese extracted the cataract and could then see the copper floating in the vitreous. The patient was put in the knee-chest position, and while in that attitude the copper fell into the anterior chamber from which it was removed with the forceps.

Dr. G. S. DIXON showed a case of **epithelioma of the limbus,** for Dr. REESE. The patient, a man, aged fifty-five, three years ago had an epithelioma of the right cheek, which was removed. When the bandage was taken from the right eye

and cheek, that eye was found to be blind as a result of embolism of the central artery. Two years ago, a tumor appeared at limbus of O. S., which encroached so much upon the cornea that the patient had to be led around. Radium was tried four or five times, but the condition seemed to get worse, until the tumor was ligated, cutting off the blood supply. Dr. Dixon then continued the application of the radium until now, with the result that the epithelioma is about all gone. The original point on the cornea, from where the tumor was dissolved, is now clear. The man has now $\frac{20}{30}$ vision. A section of the tumor showed it to be epithelioma.

Dr. W. B. WEIDLER showed a case of **acromegaly with exophthalmos.** M. S., æt. 37, Hebrew, complained of pains in the legs, and weakness in the feet since June 7, 1914. When first seen, examination showed some physical signs of acromegaly, which have greatly increased, until at the present time the facial characteristics are well marked. Vision is $\frac{20}{30}$. Optic disks normal, possible temporal pallor. The fields are normal except some contraction for colors.

The X-ray plate showed some enlargement of the base of the sella and also of the posterior clinoid processes. The X-ray plate was exhibited.

DISCUSSION: Dr. G. S. DIXON thought there was very little enlargement of the sella and would not attach much importance to that plate.

Dr. ARNOLD KNAPP wanted to know how he explained the exophthalmos.

Dr. WEIDLER thought it might be due to a deposit of fat in the orbit.

Dr. W. B. WEIDLER showed a case of **cyanosis of the retina due to patulous foramen ovale.** Miss A. S., æt. 9, at time of birth was described as a "blue baby." At the present time the child shows a great amount of purplish blue discoloration of the lips, tongue, and all mucous membranes that can be examined, and the finger nails have a bluish discoloration. The child usually has cold hands and feet, and is unable to play or endure a slight amount of exertion without undue fatigue and exhaustion. In the eye grounds the veins and arteries are tremendously enlarged and tortuous, darker in color, the caliber being about double that usually seen. The retina is extremely

granular and gives a very bluish-red reflex, which is seen only in extreme cyanosis. Vision is normal.

Dr. W. B. WEIDLER showed a case of **hysterical amblyopia and "blue tears."** J. J., æt. 17, on September 13, 1914, first complained of headaches, and trouble in seeing. Vision was $\frac{20}{50}$ in each eye, unimproved with glasses. At present the vision is $\frac{20}{100}$ in each eye. The fields are concentrically contracted, but the patient has no trouble in orientation. There is a marked reduction of accommodation.

There has been considerable lacrimation and photophobia, with marked angio-neurotic œdema which almost closes the eyelids. Within the last six weeks the patient has been secreting a bluish-green fluid from the conjunctival sac, which gives the appearance of "blue tears." These have been examined carefully for any bacteriological growth and for the presence of any chemical matter, but without success. The patient shows other general stigmata of hysteria.

DISCUSSION: Dr. WEEKS asked if the patient had any trouble in getting about. He said that one of the characteristic symptoms of hysterical amblyopia was that if you place objects in front of the patients they can get out of the way of these objects.

Dr. H. H. TYSON asked whether the patient had been kept under constant observation in a hospital, and said he was positive that if such precautions were observed the colored tears would disappear and be replaced by those of a normal appearance, as in these cases patients resort to various devices in their endeavors at deception.

Dr. L. W. CRIGLER showed a case of **rupture of the choroid.** George T., aged 10, on October 9, 1915, was struck in the right eye with a stick. Four days later, he was brought to the Manhattan Eye, Ear, and Throat Hospital. Examination revealed dilatation of the pupil, marked ischæmia of the retina, hemorrhages surrounding the disk associated with œdema of the retina. Vision was reduced to light perception. The patient was put to bed and kept as quiet as possible, with both eyes bandaged. There was a gradual subsidence of the œdema, the hemorrhages gradually became absorbed, and the retina took on the normal color. One month after the injury, the choroidal rupture was clearly seen extending

completely around the disk. The inner temporal margin of the rupture is about two disk diameters from the nerve head. The rupture is broadest in the infero-temporal region. The rupture is concentric with the disk, but approaches it more closely in a spiral direction as it passes upward and around the disk. The narrowest point of the rupture is the supero-nasal, where the two ends of the rupture meet at an acute angle, almost in contact with the disk. Connective-tissue bands are seen in contact with the retina stretching across the gap in the choroid and extending along the surface. The vitreous chamber is entirely free from opacities.

Vision is now $\frac{1}{100}$, and the field of vision is contracted to about 20 degrees.

Dr. WEEKS said that the case was unusual though not unique, and that ruptures of the choroid vary much in character. He had once seen a case which extended through the macula. In this case the disposition of the pigment was such that it looked like a foreign body in the retina. X-ray proved negative, however.

Dr. KNAPP asked if there had been any exophthalmos, and if the ischæmia of the retina might not have been due to hemorrhage into the nerve sheath.

Dr. CRIGLER stated that he had not been able to account for the ischæmia and that he thought Dr. Knapp's suggestion of hæmatoma of the sheath was about the only way to account for it, although there was no exophthalmos.

Dr. ARNOLD KNAPP reported a case of **influenzal optic neuritis.** (This is published in the present issue.)

DISCUSSION: Dr. WEEKS said he was interested in this case, as he had read a paper before this Society on that subject in 1891. He collected all the cases he could find. He found paralysis of the external rectus, anæsthesia of cornea, one-sided ophthalmoplegia, and retrobulbar neuritis due to influenza. Of course, the examination of the blood was not known at that time. He reported a case of retrobulbar neuritis with central scotoma. Disturbances, so far as the optic nerves were concerned, were all due in his opinion to the accessory sinuses.

Dr. MARTIN COHEN asked if there were any signs of nephritis.

Dr. TYSON inquired as to what effect, if any, the lumbar punctures made in obtaining spinal fluid for tests had upon the course of the optic neuritis.

Dr. KNAPP replied that there never were any changes in the urine and that the lumbar punctures had no effect on the optic neuritis.

Dr. C. B. MEDING read a paper entitled **Compensation and insurance in eye injuries.** After briefly reviewing conditions arising from recent legislation, together with the difficulties inherent by reason of insufficient study and familiarity with the experience of other States, the author suggests the co-operation of State authorities with an official committee or board appointed by the medical profession, that since the governmental and legal factors are represented, the medical as a necessary part should be equally honored. He deprecates the position often taken by insurance-company examiners of belittling medical attendance and seeking economy of expenditure rather than efficiency and justice. The question of eye injury as related to permanent disability because of appearance as well as visual loss is discussed. The paper concludes that since compensation or indemnity and the insurance of employers against medical expense have come to stay, we as oculists should be well placed in our position as bulwarks for the patient, good citizens for the State, and intelligent preservers of ourselves.

In discussing Dr. Meding's paper, Dr. MAY said that he had had much experience in these cases and was inclined to think that the insurance companies were very fair.

Dr. WALTER E. LAMBERT said he was glad that this matter was brought before the Society. He said that the insurance companies have paid the hospitals, but not the doctors, and thinks that the doctors ought to make concession in their fees.

Dr. F. C. ARD spoke of the law in New Jersey. One of the great problems they have had to decide was how much damage has been done to an eye in a given case. For example: A young man, an electrician, has a traumatic cataract removed and good portion of iris; with cataract glass, he has fair vision. It was very difficult to explain to the court how much damage was done.

By LEWIS W. CRIGLER, M.D., Secretary.

MEETING OF MONDAY EVENING, JANUARY 17, 1916.
GEORGE H. BELL, M.D., CHAIRMAN.

Dr. W. B. Weidler presented a case of **disseminated sclerosis.** The patient, a man aged 34, married, was first seen at the Manhattan Eye and Ear Hospital on October 5, 1914, and complained of failing vision without any other ocular symptoms. Vision, right eye, $\frac{20}{100}$; left eye, $\frac{15}{100}$. The disks congested. The fields show slight peripheric contraction and a central scotoma. On December 10, 1915, vision was: right eye, $\frac{8}{200}$; left eye, $\frac{2}{200}$. The optic nerve head was pale, especially in the temporal quadrant.

Discussion: Dr. M. Schoenberg stated that he did not think that a diagnosis of multiple sclerosis had been proven in this case. In that condition there is usually a history of trauma associated with early development of optic atrophy, and vision fails after fatigue. Improvements and recurrences are usual. This patient's vision failed gradually. The central scotoma in multiple sclerosis is usually relative; in this case it is absolute. Absence of reflexes are not important, except when associated with other symptoms.

Dr. Arnold Knapp had seen the patient at the Memorial Eye Hospital and had made a diagnosis of multiple sclerosis in the absence of history of toxic amblyopia. Like lesions in tabes, the optic nerve changes may precede other lesions.

Dr. Weidler stated that he could find no evidence to indicate that it was of a toxic origin.

Dr. Weidler showed a case of **choroidal exudation** in a patient who reacted to tuberculin.

Dr. J. Bruder presented a case of **diabetic retinitis** in a man 63 years of age, with a history of having had diabetes since his eighteenth year.

Dr. M. J. Levitt presented an unusual case of **medullated nerve fibers.**

Dr. Arnold Knapp presented a case of **scleritis where the tubercle bacillus was cultivated from the aqueous.** The patient was a woman aged 28, with a history of recurring inflammation in both eyes for eight years. The scleritis

was of the deep type in which the greater part of the anterior segment of the sclera was slate-colored. The cornea showed opacities from sclerosing keratitis. There were some old posterior synechiæ. The iris structure was perfectly normal. There were no exudates in the anterior chamber and no deposits on the posterior surface of the cornea. After a tuberculin test (subcutaneous) there was a general febrile reaction. The eyes became quite red and the tension, which previously had been normal, rose in the one eye to 60 and in the other eye to 50*mm*.

An iridectomy was done in both eyes. Cultures were made from the aqueous and from the piece of iris removed at operation. Dr. Dwyer kindly suggested the Miller-Petroff medium which has recently been used with success for the growth of the tubercle bacillus. One of the four tubes gave a growth of the tubercle bacillus after about four weeks. The etiology of this case has, therefore, been proven.

Since the operation the tension has remained normal. The patient is getting tuberculin regularly and is improving. Beside the proof of the etiology in this case, the increased tension as a focal reaction was of particular interest. There must be some reason why cases of deep scleritis are particularly prone to increase in tension. This apparently was not due to a lighting up of a process in the ciliary body, as there were no fresh adhesions of the iris, no opacities of the vitreous, and no deposits on the posterior surface of the cornea to indicate an exacerbation of a cyclitis.

Discussion: Dr. Dwyer stated that Petroff's media were essentially Dorsett's egg media to which the various aniline dyes had been added in varying amounts, the object of the latter being to inhibit the growth of secondarily contaminating organisms. The principle underlying the use of these dyes is the fact that any organism that is stained by a dye is killed by it and hence growth prevented. The tubercle bacillus belongs to the acid-fast group, is not easily stained by the dyes, and hence its growth is not inhibited, while that of the secondary infecting organisms is. In pus from any source, a preliminary treatment with 3% sodium hydroxide is made which kills off most of the secondary organisms, leaving the acid-fast organisms free.

Dr. GEO. H. BELL showed a case of **chorioretinitis syphilitica.**

Dr. W. B. MARPLE showed a case of **cholesterine crystals in the anterior chamber** in a blind eye.

Dr. MARTIN COHEN showed a case of **inclusion cell conjunctivitis.** He thinks that most ophthalmologists confound this disease with trachoma. The chief points of difference are: the papillary hypertrophy of the tarsal conjunctiva shows the papillæ to be more numerous and closely studded together. Pannus practically never occurs, and the conjunctiva returns to normal without any scarring or thickening of the conjunctiva whatsoever. Little or no treatment is required. Dr. Cohen will show the case again to the section in three months' time for comparison.

Dr. KNAPP asked if the papillary hypertrophy was characteristic, and if the disease was contagious.

Dr. COHEN replied affirmatively. The upper lid had required two weeks to take on the hypertrophy and the lower lid four.

Dr. MARTIN COHEN next reported a case of **bilateral metastatic panophthalmitis associated with broncho-pneumonia,** which appears in full in this issue.

DISCUSSION: Dr. DWYER thought that the case was one of pyæmia. It is possible to have this condition in the face of several negative blood cultures.

Dr. WOLFF suggested thrombosis of the cavernous sinus as a possible etiological factor.

Dr. COHEN said that sinus thrombosis could be ruled out on the ground that the patient had no cerebral symptoms.

Treatment of rheumatic affections of the eye with vaccines of streptococcus viridans. By Dr. J. HERBERT CLAIBORNE. The paper was based on the experience gained in the treatment of three cases, two of mild anterior uveitis and one of choked disk.

The complement fixation test for streptococcus viridans was found positive in the three cases, and vaccines were given prepared from stock cultures in the laboratory. The first case was that of a man who recovered under the combined administration of atropine, hot water, and vaccine. He had been previously treated by other surgeons with the remedies ordinarily used, without relief. Starting with about 1½

drops or $\frac{1}{10}cc$, the dose was increased slightly, every four to five days approximately, until he received twelve drops. During this period there were two slightly negative phases; the latter one occurring on January 19th when he received twelve drops. Subsequent to this dose the patient received a final dose of ten drops. The treatment continued between November 17th and January 28th. The patient recovered completely, and at the end of three years has had no return of the uveitis.

The second case was that of a lady of fifty who had right-sided choked disk. Her blood reaction to the Wassermann test was negative. Her kidneys were normal. Dr. Claiborne suggested to Dr. Richards that he make a complement fixation test for the streptococcus viridans. This was done and proved positive. A vaccine was then prepared from stock cultures in the laboratory. Dr. Richards administered thirteen injections to the patient, ranging from $\frac{1}{10}cc$, the initial dose, to $\frac{8}{10}cc$, the final dose. The treatment extended from October 15th to December 3d. Vision improved from $\frac{20}{100}$ to $\frac{20}{30}$ during that time. Dr. Claiborne thought it reasonable to assume that the improvement was caused by these injections. Her general condition improved at the same time.

The third case was that of a young lady of twenty-five with intense uveitis associated with episcleritis. The complement fixation being positive, Dr. Richards gave her the vaccine made from stock cultures prepared in the laboratory, starting with $\frac{1}{10}cc$. Under this treatment the patient improved considerably but went backward once or twice, and at the time of this report, the eye is in about the same condition as it was the month previously. Dr. Claiborne thought that he had started too late with the vaccines.

Toward the latter part of the treatment she developed a slight keratitis which resulted in a hemorrhage into the anterior chamber. This occurred after leaving off the atropine for a day or two.

Dr. Claiborne said that he brought the attention of the Section to this matter in the hope that it would lead to a broader field of investigation, particularly as regards disease of the uveal tract when no cause can be found by other methods of investigation.

DISCUSSION: Dr. J. H. LEVY, D.D.S., who was invited by the section to join in the discussion, said that he had not succeeded in finding streptococcus viridans in the blood in such cases as Dr. Claiborne cites. He thinks dental infection the primary source of the streptococcus viridans in the majority of cases, and that it becomes a very serious matter whenever the germ enters the blood. It is the blind dental abscess, which never gives pain and which can be recognized only by means of a radiograph, that causes a great many of these secondary manifestations. Relief is usually prompt as soon as the condition of the teeth is relieved.

Dr. DWYER said that he thought Dr. Claiborne's report intensely interesting, but at variance with his findings. He too said that his results with streptococcus viridans had been absolute failures. That in the case of positive bacteræmia all cases succumb. With the local lesion in the teeth, however, the story is quite different, good results being obtained. Results in combating the streptococcus hæmolyticus have been much more satisfactory.

Dr. H. H. TYSON stated that in his experience, in order to obtain permanent good results in these cases, it was necessary to remove the foci of the infection where possible, and in case of the teeth, to have them removed before one could expect to effect a cure. He related two cases illustrating this point: One was a young man who had frequent attacks of temporary loss of vision, with a mild optic neuritis. The offending teeth were extracted, vision improved with cessation of attacks, and the optic neuritis subsided.

In the second instance, a very unfortunate case of arthritis deformans with chronic uveitis, extending over a period of two years to date, the vision in one eye was practically lost, and in the other eye light perception, only, remained in spite of treatment with various vaccines and serums, including streptococcus viridans, thyroid and thymus extracts, and all local and general treatment available in such cases, except the removal of all offending teeth, to which objection was made. Finally some of the affected teeth were removed, but as some were retained no improvement followed.

REPORT OF THE TRANSACTIONS OF THE SECTION ON OPHTHALMOLOGY OF THE ROYAL SOCIETY OF MEDICINE.

By C. DEVEREUX MARSHALL, F.R.C.S., London.

An ordinary meeting of the Section was held on the 2d of February under the presidency of Mr. Priestley Smith.

The following cases were shown: Mr. J. Herbert Fisher, **arteriovenous aneurysm;** Mr. Arnold Lawson, **coloboma of the upper eyelid;** Dr. Attlee, **congenital dermoid of the conjunctiva;** Mr. G. H. Pooley, **lymphoma of orbits.**

A paper by the late Mr. George Coats was read by Mr. Affleck Greeves, entitled **The cause of the ophthalmoscopic appearances in amaurotic family idiocy.** The author, in this paper, deals with a contribution by Dr. F. E. Batten and Mr. Stephen Mayou on **family cerebral degeneration with macular change,** in which those authors state that there is a close relationship between these cases and the instances of amaurotic family idiocy, the only difference between them being that the macular region in amaurotic family idiocy shows a much more marked œdema of the internuclear layers, and therefore a white area around the macula associated with a hole or thinning of the retina at the fovea due to œdema, their conclusion being that œdema of the internuclear layers was present in both diseases, but much more markedly in amaurotic family idiocy. In the present paper the author says that for a histological study of the retina, the material must be absolutely fresh, as post-mortem changes begin two hours after death; fixation must be perfect (Zenker's solution being the best), and the method of cutting must be suitable. Coats considered that in the retina, apart from the occurrence of œdema, the macular changes show marked differences in the two diseases, and these

are enumerated. He repudiates the view which had been ascribed to him that the ophthalmoscopic appearances in amaurotic family idiocy are due to coagulation necrosis. Though the particular form of chromolysis, vacuolization, etc., which characterize family cerebral degeneration, closely simulates that which is seen in amaurotic family idiocy, the underlying cause may be different; and the race selectiveness of amaurotic family idiocy should cause hesitation in identifying it with a disease which is not race selective.

Mr. MAYOU, in discussing the paper, agreed that formalin, which was used in the case described by Dr. Batten and himself was not a good fixative, but in one of the cases reported he thought the appearances could be fairly relied upon, except in regard to œdema in the internuclear layers.

Mr. TREACHER COLLINS thought the paper might well have been entitled **Causes of opacity of the retina,** as it dealt with the wider subject. In the class of case investigated by the author, he seemed to have established that the opacity of the retina was due to a change in the ganglion cells.

Mr. J. HERBERT PARSONS said he had cut sections from a case of amaurotic family idiocy, and there were large œdematous spaces, similar to those in Dr. Batten's and Mr. Mayou's case, and he did not think they could be explained merely as the result of bad fixation. A good fixative, like the Zenker, might cause an artefact appearance in the opposite direction to that alleged in this paper. He regarded amaurotic family idiocy as one of the most sharply defined clinical entities known.

Mr. HOLMES SPICER and Mr. AFFLECK GREEVES contributed a paper on **superficial linear keratitis.** The condition was one in which there were superficial ridges of epithelium raised above the level of the cornea, mostly running in vertical lines, gray and tapering, and having along their course bulging node-like appearances. They had tapering ends, and did not extend quite to the limbus. They not uncommonly showed punctate staining, but there was no iritis. The tension of the eyeball was nearly always *minus*, and during such times the vision was definitely impaired, though it recovered when the normal tension was re-established. It differed from dendritic ulcer (which it appeared to simulate) especially in the reduced

tension. No measures which he had employed prevented recurrences. A number of drawings and microphotographs illustrated the contribution. It was discussed by Messrs. COLE MARSHALL, J. B. LAWFORD, and D. L. DAVIES.

Mr. WALTER EDMUNDS read a paper on **cataract in experimental thyroidectomy.** He said he did not think the lens opacity was due to disease of the eye itself; in the dogs dealt with the pupil was active, and there was perception of light. He thought the cataract was due to the general nutritional changes following the removal of the thyroid gland, and the fits seemed to be due to that. Similar instances had been recorded in man. The cataractous changes which he found were not of the lamellar or any special type. When the parathyroids were also removed, the animal quickly sickened and died, the death being preceded by tremors.

The paper was discussed by Messrs. HERBERT PARSONS and HERBERT FISHER, and Mr. EDMUNDS replied.

QUARTERLY REVIEW OF THE PROGRESS OF OPHTHALMOLOGY.

By H. KOELLNER, Berlin; W. KRAUSS, Marburg; R. KÜMMELL, Erlangen, W. LOEHLEIN, Greifswald; H. MEYER, Brandenburg; W. NICOLAI, Berlin; H. PAGENSTECHER, Strassburg; K. WESSELY, Würzburg; and M. WOLFRUM, Leipsic, with the Assistance of Drs. ALLING, New Haven; CALDERARO, Rome; CAUSÉ, Mayence; DANIS, Brussels; GILBERT, Munich; GROENHOLM, Helsingfors; v. POPPEN, Petrograd; TREUTLER, Dresden; and VISSER, Amsterdam.

Edited by MATTHIAS LANCKTON FOSTER, M.D., F.A.C.S., New Rochelle, N. Y.

THIRD QUARTER, 1915.

I.—GENERAL OPHTHALMIC LITERATURE.

1. ALLPORT, FRANK. **Some facts concerning the blind.** *Journal A. M. A.*, September 4, 1915.
2. BURPITT, H. R. **Mental retardation, nutrition, and eyesight in school children.** *Ophthalmoscope*, September, 1915.
3. O'CONNER, R. **The relation of the eyes to rifle shooting.** *Ophthalmology*, July, 1915.
4. PHILLIPS, W. L. **The significance of the transparency of the retinal blood column.** *Annals of Ophthalmology*, July, 1915.

According to ALLPORT (1, **Some facts concerning the blind**), the total blind population of the United States is 57,272—sixty-two blind persons to every one hundred thousand. Excessive blindness in New Mexico, Nevada, and Arizona is probably due to the prevalence of small-pox and to trachoma in Kentucky, Tennessee, and Virginia. One half of the blind are over sixty years of age.

ALLING.

BURPITT (2, **Mental retardation, nutrition, and eyesight in school children**) studied the mental backwardness of children, aged from thirteen to fourteen, in relation to their vision. He

considers as seriously retarded, those children who are three years behind in their school work, and gives the following table showing the percentages of such failures compared with their vision:

The children with	$\frac{6}{6}$	are represented by	14.4	per cent.					
"	"	"	$\frac{6}{9}$	"	"	"	18.0	"	"
"	"	"	$\frac{6}{12}$	"	"	"	23.1	"	"
"	"	"	$\frac{6}{18}$	"	"	"	22.3	"	"
"	"	"	$\frac{6}{24}$	"	"	"	20.6	"	"
"	"	"	$\frac{6}{36}$	"	"	"	19.4	"	"
"	"	"	$\frac{6}{60}$	"	"	"	40.0	"	"

His table, which shows the state of nutrition compared with vision acuity, shows that those with the higher vision have also the higher nutrition, and he concludes that the worse the vision the more is the child retarded mentally.

CURRAN.

O'CONNER'S paper (3, **The relation of the eyes to rifle shooting**) is a thorough discussion of the subject and a refutation of the contention that good shooting is consistent with poor vision. He shows that it is necessary to focus both the front and the rear sights by accommodation in order to obtain an alignment on the target, but that the bull's eye must be clearly seen with the accommodation and relaxed when the trigger is pulled. He gives the evidence of expert rifle shots and statistics to prove that the men who make the best scores have, almost without exception, normal vision. He thinks that $\frac{20}{10}$ should be required of all men of the line in the regular army.

ALLING.

It is well known, as pointed out by PHILLIPS (4, **The significance of the transparency of the retinal blood column**), that the retinal blood-vessels are transparent but the blood should be opaque. He has observed a few cases in which he could see the underlying vein through the overlying artery, and blood examinations in all cases showed hæmoglobin below normal. Lack of transparency does not necessarily mean a normal condition for there may be sclerosis of the vessels. On the other hand, transparency of the blood column would indicate absence of sclerosis.

ALLING.

II.—RELATIONS OF OPHTHALMIC TO GENERAL DISEASES, INCLUDING POISONS.

5. BATTEN, F. E., and MAYOU, M. S. **An interesting report on a family, consisting of one male and four females, showing maculocerebral degeneration.** *Proceedings of the Royal Society of Medicine, Section of Ophthalmology,* March, 1915.

6. BUSSMANN, H. **Treatment of herpes zoster ophthalmicus with salvarsan.** *Dissert.*, Greifswald.

7. DEAN, L. W. **Report on ocular findings in two cases of xeroderma pigmentosum.** *Ophthalmology,* July, 1915.

8. DUNN, H. PERCY. **Some aspects of the ciliary body in health and disease.** *Lancet,* May 29, 1915.

BUSSMANN (6, **Treatment of herpes zoster ophthalmicus with salvarsan**) reports two cases. In the first there was a formation of blebs without ulceration or any involvement of the globe; healing following two injections of 0.45 neosalvarsan in 20*ccm* of physiological salt solution. The second case showed ulceration as well as elevations, and in places erosions of the epithelium; healing took place in sixteen days after an injection of 0.2, and six days later 0.3 of salvarsan, though without change of the corneal affection. In both cases Wassermann's test was negative.

BATTEN and MAYOU (5, **An interesting report on a family, consisting of one male and four females, showing maculocerebral degeneration**) sum up the retinal changes by saying that there is a disappearance of the neural elements, starting first with the ganglion cells and ending with the inner nuclear layer and rods and cones with a slight increase in the supporting structure. Sometimes there is a migration of pigment forward from the pigment-cell layer. In his case the microscopical picture closely resembles that seen in amaurotic family dementia. The changes in the macula are, however, not always present. The disease is characterized by progressive paralysis and progressive dementia. It resembles the Tay-Sachs family amaurotic idiocy in that it has a familial character. The absence of syphilis and the clinical symptoms and course are similar. The difference lies in the absence of race proclivities, the absence of characteristic macular changes, and the difference of age.

CURRAN.

Xeroderma is a rare disease. The first signs are usually

found on the face, especially the eyelids, in the form of freckle-like spots. Later warty elevations appear and these are converted into true sarcoma and carcinoma. The progress of the disease is associated with entropion, ectropion, and opacity of the cornea. The first case reported by DEAN (7, **Ocular findings in xeroderma pigmentosum**) was a female child eight years old. The skin was covered with numerous pigment spots and irregular tubercle-like nodules. There was entropion, due to the warty masses in the eyelids, which proved to be carcinoma. There was thickening of the conjunctiva and whitish elevations on the cornea with a general diffuse opacity. The second case, a brother, showed similar skin lesions but no excrescences. The conjunctiva was thickened and there were yellowish-white elevations on the cornea. In the case of the girl, on account of the extensive involvement of the lids, it was necessary to resort to a plastic operation.

ALLING.

DUNN (8, **Some aspects of the ciliary body in health and disease**) treats certain types of cyclitis, which he regards as symptomatic hypothyroidism, with thyroid extract. He also finds it of value in corneal ulcers of the strumous type and cyclitis accompanying interstitial keratitis of hereditary syphilis. He assumes that the thyroid gland is called upon to make strenuous efforts to combat the toxæmia which is causing the eye trouble. For a time these efforts may be successful, but later the thyroid fails and we have hypothyroidism. Then the toxæmia becomes uncontrolled. There is diminished resistance of the tissues; this may render them a prey to bacillary infection. In treating children over five years of age he gives three grains of the extract twice daily.

CURRAN.

III.—GENERAL AND EXPERIMENTAL PATHOLOGY AND TREATMENT.

9. ALT, A. **A large pigment ball between the detached retina and choroid.** *American Journal of Ophthalmology*, June, 1915.

10. WAELE. **The behavior of traumatic cataract during the specific "anaphylactic state."** *Arch. f. Ophthalm.*, xc., p. 165.

11. ZADE. **Intracorneal inoculations of bacteria.** *Ibid.*, p. 256.

ALT (9, **A large pigment ball between the detached retina and choroid**) examined a phthisical eye, the result of a pene-

trating wound. The appearances were those of an eye destroyed by an infectious process of traumatic origin, except that a spherical mass of dense pigment was found lying beneath the detached retina posterior to the ciliary body. It was large enough to be seen macroscopically and so dark that no cell outlines could be made out. The wall was surrounded by a connective-tissue capsule, broken at one point, as if torn from its attachment.

ALLING.

WAELE (10, **The behavior of traumatic cataract during the specific "anaphylactic state"**) concludes that in animals which have been treated previously either special coagulation generators are present, or that the conditions are rendered much more favorable to the formation of a clot. The process of healing is retarded, absorption appears later and is more thorough. Although absorption seems to come later, it is stronger.

ZADE (11, **Intracorneal inoculations of bacteria**) concludes that the intralamellar injection is best suited for inoculation of the cornea because the dosage is more uniform and the results therefore more constant. The interstitial tissue of the cornea is to a high degree without protection against infectious agents, yet the lack of protection is less than in the vitreous. In consequence of this relative lack of protection pathological symptoms may be excited in the cornea with bacteria, which cannot be excited by them in other organs. The intracorneal inoculation of rabbits may be of value in the differentiation of diphtheria bacilli from diphtheroid, especially as morbid symptoms may be produced in the cornea by avirulent diphtheria bacilli. In immunized rabbits a marked phagocytosis sets in after intracorneal inoculation of diphtheria bacilli, which is absent in animals not thus protected. Influenza bacilli may multiply in the cornea; meningococci and gonococci damage the cornea without noticeable increase.

IV.—METHODS OF RESEARCH, REMEDIES, INSTRUMENTS, AND GENERAL OPERATIVE TECHNIC.

12. STEPHENSON, SYDNEY. **Tincture of iodine in eye work.** *Ophthalmoscope*, July, 1915, p. 326.

13. STUMPF. **A glass lid elevator.** *Muench. med. Wochenschr.*, p. 1102.

14. TODD, F. C. **A cataract incision leaving an undetached conjunctival flap with a bridge of conjunctiva on the temporal side.** *Ophthalmic Record*, August, 1915.

STUMPF (13, **A glass lid elevator**) has modified Desmarres' lid elevator by having it made of glass. The advantages he claims for it are that it may be sterilized more easily, that it does not obscure the field of operation, that it can be used in extractions with the giant magnet, that its manufacture is simple, and that it is cheap.

STEPHENSON (12, **Tincture of iodine in eye work**), in commenting on the few cases of irritation after the use of tincture of iodine in preparation of the parts for eye operations, reports a case of his own in which 3% tincture of iodine was used to sterilize the skin. The following day the parts were swollen and bright red, looking like erysipelas. The condition subsided in a few days. He suggests that erythematous dermatitis is due to an idiosyncrasy on the part of some patients and in support of this quotes a case of dermatitis produced in another patient whose eye was covered with a compress steeped in boiled water and which was followed by dermatitis.

CURRAN.

TODD (14, **Cataract incision with an undetached conjunctival flap**) has tried a new incision which he thinks has all the advantages of the suture operation and much easier to perform. He makes puncture and counterpuncture in the usual way, but immediately continues the incision with the point end of the knife by turning the handle downward. The result is that the cut is finished on the temporal side and a large part of it will be underneath an undermined conjunctival flap.

ALLING.

V.—ANATOMY, EMBRYOLOGY, MALFORMATIONS.

15. BIRNBAUM. **Exophthalmometric measurements of normal eyes and their relations to the size of the orbital opening.** *Arch. f. Ophthalm.*, xc., p. 378.

16. DURLACHER. **Cyclopia with a proboscis.** *Deutsche medicinische Wochenschrift*, p. 1128.

17. HEGNER. **Concerning the behavior of the zonula fibers in ectopia lentis.** *Klin. Monatsbl. f. Augenheilkunde*, lv., p. 22.

18. HEGNER. **The dependence of the growth of the lens on the zonule of Zinn.** *Ibid.*, p. 30.

19. SATTLER. **The development of the medullary sheaths in the optic tract, chiasm, and optic nerve.** *Arch. f. Ophthalm.*, xc., p. 271.

20. SCHWARTZ. **A case of faulty construction, hypoplasia, of both optic nerves.** *Ibid.*, p. 326.

21. SEEFELDER. **A pathological contribution to the study of coloboma and of circumscribed grooves on the head of the optic nerve.** *Ibid.*, p. 129.

22. WOLFRUM. **A case of persistent pupillary membrane, with remarks on the question of coloboma.** *Ibid.*, p. 471.

BIRNBAUM (15, **Exophthalmometric measurements of normal eyes**) finds that prominent eyes coincide with large and oval openings of the orbit, while the eyes are deeply seated when the openings are small and round. The measurements were made principally on soldiers whose refraction varied from − 1 to + 2 D, and were taken with Hertel's exophthalmometer.

SATTLER (19, **Development of the medullary sheaths**) found in fetuses 37 to 45*cm* long medullated fibers abundant in the optic tract, scarce in the intracranial portion of the optic nerve, and totally wanting in the intraorbital portion. At the time of birth the medullated fibers have pressed forward close to the lamina cribrosa, at least in some cases. There are marked individual differences. The development of the medullary sheaths takes place in a centrifugal direction. In the eighth fetal month the medullated fibers have an average thickness of 1*m*. Their thickness gradually increases with age. In infants the fibers in the optic nerve may still be more delicate than in the tract. At the time of the formation of the medullary sheaths the glia seems to be particularly rich in granules of lecithin, and the young medullary sheaths are not tubes, but consist of fine deposits of lecithin granules about the axis-cylinders.

The child described by DURLACHER (16, **Cyclopia with a proboscis**) lived for half an hour. In addition to the cyclopia and proboscis it had polydactylia. A central canal in the proboscis was round and lined with several layers of cylindrical epithelium. Branched tubular mucous glands sank from the epithelium into the surrounding connective tissue. Large arteries and veins, as well as several nerve trunks ran longitudinally in the proboscis. A cross-section through the rhomboidal groove revealed a covering of horny flat epithelium

with hairs and some sebaceous glands. At each side there was a pocket with a fold resembling a palpebral margin; in this fold there were many hair rudiments, and here the epithelium changed gradually to a stratified cylindrical epithelium. At the base of the proboscis there was a folded sac with collapsed walls, which consisted of two adjoining cavities. The wall consisted of very cellular connective tissue, within which was a vascular layer lined by a layer of pigment. The contents were traces of an undifferentiated retinal layer. No lens tissue was found. No section was made of the brain.

WOLFRUM (22, **Persistent pupillary membrane**) reports a peculiar case of pupillary membrane met with in the right eye of a girl 9 years old. The entire region of the pupil was displaced upwards and the pupil was not round. The cause was the pupillary membrane, which had stretched to a cord the lower part of the pupillary margin, and had caused a sort of angle in the upper part of the pupil by a process which made impressions in the iris, extended to the angle of the anterior chamber, and was inserted in the periphery into the posterior surface of the cornea.

Defects in the zonule of Zinn are not always present in congenital displacement of the lens, according to HEGNER (17, **The fibers of the zonule in ectopia lentis**). In many cases the platelike depression of the vitreous adapts itself to the eccentric position of the lens and so affords it a better support. The fibers of the zonule are stretched at the corresponding places so that gradually they give way and spaces are produced secondarily. This is indicated by the fact that sometimes remains of the fibers may be observed on the margin of the lens.

The same writer (18, **The dependence of the growth of the lens on the zonule of Zinn**) gives two examples in which after iridectomy the margin of the lens became irregular in consequence of laceration of the fibers of the zonule. At the affected places the lens remained backward in development, while elsewhere, where the fibers of the zonule were preserved, the margin developed properly. The cases form an illustration of the dependence of the growth of the lens upon the zonule in Wessely's animal experiments.

In an infant in whom one eye presented a typical coloboma,

SEEFELDER (21, **Study of coloboma and of circumscribed grooves on the head of the optic nerve**) found a pocket-like invagination of the papilla of the other. The contents of the pocket were formed mainly of rudimentary retinal tissue. The lamina cribrosa was absent in the region of the pocket. The central vessels appeared in the upper part of the physiological excavation of the papilla. Among other things it is noteworthy that a part of the tissue in the pocket consisted of pigment epithelium. The sheath of the optic nerve was invaginated at the site of the pocket. Finally the pocket formed a depression toward the vitreous which had appeared ophthalmoscopically as a groove. Seefelder considers this case to furnish new evidence that the so-called grooves in the optic nerve should be classed among the colobomata.

SCHWARTZ (20, **Hypoplasia of both optic nerves**) reports this peculiar case, which he met with in a girl 18 years old. In each eye the papilla was replaced by a small, irregular, white spot with a slightly thinned place in the choroid adjoining. Vision was reduced to about .5, and there was an almost complete defect of the nasal half of the visual field. Apparently the decussated bundles in the optic nerves were almost wholly wanting. There were no other anomalies in the otherwise well built girl. Only a single similar case has been described heretofore.

VI.—NUTRITION AND TENSION.

23. BERG. **Visible currents in the anterior chamber.** *Klin. Monatsbl. f. Augenheilkunde,* July-August.

24. HERTEL. **Clinical studies concerning the dependence of the tension of the eye upon the condition of the blood.** *Arch. f. Ophthalm.*, XC.

25. REMELÉ. **The passage of urotropin into the aqueous and the splitting off of formaldehyde that takes place there.** *Ibid.*

By means of the binocular loupe and the Nerst light BERG (23, **Visible currents in the anterior chamber**) was enabled to see currents in the anterior chamber. Very minute opacities in the aqueous could be seen to move upwards in the region of the pupil and down along the posterior wall of the cornea. The phenomenon may be observed particularly well in patients who have been operated on for cataract, in whom very minute corpuscular elements always are present in the aqueous in the

first weeks after operation, while the depth of the chamber accelerates the movement.

After an intravenous injection of 2 grams of urotropin in a 10% solution, REMELÉ (25, **Passage of urotropin into the aqueous**) found in rabbits that the aqueous contained the drug in a proportion between 1 to 5000 and 1 to 1000, which slowly decreased after the fourth hour. A setting free of formaldehyde also could be demonstrated, but it is so slight that no antiseptic action in the aqueous can be ascribed to it.

HERTEL (24, **Dependence of the tension of the eye upon the condition of the blood**) finds that if a healthy person with normal eyes drinks from 20 to 30 grams of salt dissolved in 120*ccm* of hot water, the intraocular tension will fall 15*mm* or more, to return to normal at the end of from four to six hours. In an experiment on himself he was able by the forced taking of salt to reduce the tension of his eyes to 4*mm*, so that the softness of the eyes caused great distortion of the images with each wink of the lids. Quicker and more exact depression of the tension was produced by the intravenous injection of from 100 to 200*ccm* of a five or ten per cent. solution of salt. In this way he has been able to reduce the tension even in the worst cases of glaucoma so that an iridectomy could be readily performed, and to intensify the action of myotics. While it is always easy to increase the osmotic concentration of the blood materially by the administration of salt, the opposite, reduction of the concentration by increased imbibition of water, is not so easy. On account of the danger of hæmolysis the water can be given only by mouth and not intravenously, and even the drinking of two liters within three-quarters of an hour does not markedly reduce the concentration of the blood, or cause increase of tension. But it may be that the abnormally high osmotic concentration and the hypotony in diabetic coma may be obviated by the intravenous injection of physiological salt solution, as he ascribes these to an abnormally high content of sugar in the blood and the presence of acetone bodies, rather than to any special tension-reducing substance in the serum. On the basis of these results Hertel considers the question whether a diminished concentration of the blood may not play an ætiological part in glaucoma. He studied particularly young patients with glaucoma, who had no general disease and

had a normal blood pressure. In five such he found the osmotic concentration below the normal lower limit, and likewise the content of albumin, while patients with nephritis and high concentration of the blood showed a low index of tension in spite of high blood pressure. The blood pressure therefore he thinks takes no part in the causation of glaucoma, while the thinning of the blood may, not only in a sudden osmotic change but also chronically. One case, in which the osmotic concentration of the blood was determined before and during an acute attack of glaucoma, did not show the expected diminution, but an increase, so he thinks that the escape of water from the vessels depends not only on the osmotic concentration of the blood, but also on the permeability of the vessels. Psychi-stimuli and cold encourage the escape of water from the vessels and so may give rise to glaucoma, while warm baths and blood-letting favor the reception of water from the tissues and so act favorably on glaucoma. A large number of new problems are opened up by these studies.

VII.—THE SENSE OF SIGHT.

26. CORDS. **The visual function in intraocular hemorrhage and in closure of the lids.** *Archiv f. Ophthalmologie*, xc., p. 98.

27. HERING. **Purkinje's phenomenon in the central area of the visual field.** *Ibid.*, p. 1.

28. LANGDON, H. M. **Hereditary deficiency of the light sense in otherwise healthy eyes, with report of a case.** *Annals of Ophthalm.*, July, 1915.

Evidence that even the central area of the visual field, meaning the foveal area that is free from rods, possesses an adaptation to the dark, though less than the peripheral areas of the retina, is shown by HERING (27, **Purkinje's phenomenon in the central area of the visual field**) by an apparatus that he has constructed. Blue lights appear brighter than red in the dusk, even when they appear darker by daylight.

CORDS (26, **The visual function in intraocular hemorrhage and in closure of the lids**) concludes from his experiments that if the anterior chamber and vitreous are filled with blood there is no perception of light even when looking directly at the sun. When they are half filled with blood only sources of light of more than twenty-five-candle power can be perceived when they are close to and in front of the eye, while projection is

always bad even for stronger lights. In hemorrhage into the anterior chamber a candle light can be recognized at a meter at least; the projection is uncertain. The vision is approximately normal through a layer of blood 0.6*mm* thick. When the lids are closed completely the light from a wax candle can perceive well at from ½ to 1 meter, but the projection is inaccurate even for stronger lights.

LANGDON (28, **Hereditary deficiency of the light sense**) found that his patient, a woman of forty-six, had suffered from deficient light sense throughout her life and that her father was affected in the same way. The Henry optometer showed the light sense to be ⅔ of normal and that of her father ¾ normal. A number of instances are on record in which this defect has appeared in various generations of the same family.

ALLING.

(*To be Continued*)

CORRESPONDENCE.

To the Editor of the ARCHIVES OF OPHTHALMOLOGY,
10 East 54th St., New York, N. Y.

DEAR SIR:

In a paper entitled "Tenotomy of the Inferior Oblique Muscle," read by me before the American Ophthalmological Society and published in the last number of the ARCHIVES, the statement was made that the literature contains no mention of tenotomy of this muscle from the time of its introduction into ophthalmology by Landolt in 1885 to the publication of a paper upon the subject by Duane in 1906. Within the past few days, I have received a letter from Dr. G. C. Savage, of Nashville, Tenn., in which he calls my attention to the following, as it appeared in his work on *Ophthalmic Myology*, published in 1902:

"By far the most troublesome cases of esotropia—the incurable cases, under the old methods of operating—are those complicated by plus cyclotropia and double hypertropia. The primary deviation is in and up, and the eye is torted out; likewise, the secondary deviation is in and up, and the eye is torted out. In these cases the double hypertropia and the plus cyclotropia are both caused by overaction of the inferior obliques, while the whole of the esotropia is caused by overaction of the two interni, a large part of this overaction of the interni being in the nature of spasm. In some of these cases a division of the two inferior obliques will cure the double hypertropia, the plus cyclotropia, and the esotropia."

Dr. Savage also adds in his letter: "Several years before 1902 I had published, from time to time, statements connecting the inferior oblique with some forms of esotropia. I have

often operated on the inferior oblique, both at or near its origin in the floor of the orbit and also at its attachment. In operating at the former point, the muscle, of course, is divided completely, and with the Graefe knife, as set forth in the reference made above, but in operating at its attachment, I have divided only the anterior and middle fibers with the Stevens scissors and the medium-size hook. I have not operated through an opening in the skin of the lower lid, nor do I deem that the proper method. The only thing to be avoided in the use of the Graefe knife at the floor of the orbit is the infraorbital vessels and nerves, but this can be easily done."

In another part of his book, Dr. Savage gives a full reference to the work of one John Taylor, whom he designates as a "quack," who flourished in the first half of the eighteenth century. According to the description of a contemporaneous writer quoted by Savage: "Taylor passed a silk thread through a fold of conjunctiva at the lower-inner part of the globe, and, drawing this fold forward by means of his loop of thread, cut it with a pair of scissors. The location of this conjunctival cut makes it appear possible that, through it, he passed his scissors with the point of one blade in contact with the orbital floor, and sufficiently far backward to include the inferior oblique muscle, which he may have divided by closing the blades of the scissors; or through the opening he may have passed, in a skillful way, one blade of the scissors between the sclera and the tendon of the internus while keeping the other blade between the conjunctiva and the tendon, and thus effected the division of this tendon." Savage says: "Taylor must have had some cures, whatever may have been the nature of his operation."

Naturally, I am most grateful for Dr. Savage's letter of correction and am only too glad to give publicity to his work.

Faithfully yours,

WM. CAMPBELL POSEY.

PHILADELPHIA,
March 29, 1916.